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DEVELOPMENT OF SAYANSKIY TERRITORIAL COMPLEX DETAILED

Spatial Pattern of the Sayan TPK

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA
OBSHCHESTVENNYKH NAUK in Russian No 1, Jan 79 pp 40-48

[Article by M. A. Malinovskaya, Institute for the Economics and Organization
of Industrial Production of the Siberian Department of the USSR Academy of
Sciences, Novosibirsk]

[Text] The 9th and 10th 5-year plans can be regarded as Phase I in creating the Sayan TPK [regional industrial complex]. It is taking shape in an area which with respect to its productive potential already occupies an important place in the economy of Krasnoyarskiy Kray: for example, the enterprises of the TPK are producing 63 percent of the gross output of light industry and the food industry and occupy a leading position in the production of agricultural products (ranging from 34 to 70 percent for various farm products). The favorable natural and climatic conditions make agriculture one of the leading sectors for specialization of the TPK. A major electrical equipment complex of machinebuilding plants (city of Minusinsk) and a transport machinebuilding plant (city of Abakan) is being built in the TPK. Construction has begun on an aluminum plant (city of Sayanogorsk). This is the location of the Sayano-Shushenskaya GES, the world's largest. Development of the industrial sector relies on a very large construction capability (including building materials enterprises).

The spatial pattern of the complex has been taking shape in Phase I along with its production structure. In the central and southern parts of the area covered by the Sayan TPK three major industrial centers are being created: the Abakan-Chernogorsk, Minusinsk and Sayanogorsk; they constitute its industrial nucleus. Some of the enterprises now being built will also be under construction in Phase II of the TPK's development (1981-1990). In addition, there are also plans to build in the complex a number of large production units in various industries.

Research has been done on this complex over a number of years in the sector for formation of the TPK of the Institute for the Economics and Organization

of Industrial Production of the Siberian Department of the USSR Academy of Sciences. A set of instruments has been worked out for solving the practical problems by means of mathematical-economic modeling.¹ Calculations were made to optimize the spatial structure of the Sayan TPK by means of the mathematical-economic model entitled "Spatial Structure of an Individual TPK."² The variants of the calculations reflect different situations of Phase II in formation of the spatial structure of the TPK as a function of changes in the various conditions. Two series of calculations were made. In each series the calculations were based on a certain set of production operations in the industries in which the complex is specializing, of sites for industrial and public works construction and of the area's conditions (Tables 1 and 2).

Table 1. List of Production Operations of the Sayan TPK (for the variants of the computations)

<u>Production Operation</u>	<u>Code</u>	<u>Series of Computations</u>	
		<u>I</u>	<u>II</u>
Ferrous Metallurgy			
Complete cycle	M	+	-
Quality steels	Ks	+	+
Ferroalloys	Fer	+	+
Structural steel	Met	+	+
Nonferrous Metallurgy			
Aluminum and rolled products	Al, Pa	+	+
Alumina	Gl	+	+
Processing of nonferrous metals	Ots	+	-
Chemical Industry			
Electrochemistry	Ekhk	+	-
Synthetic fiber	Iv	+	-
Manufactured fertilizers	Mu	+	+
Plastics processing	Op	-	+
Machinebuilding			
One of the subindustries of machinebuilding (group of plants)	Mk-1	+	+
Of another subindustry (group of plants)	Mk-2	+	+
Transport machinebuilding	Tm	+	+
Ship repair	Sr	-	+

Table 1 (continued)

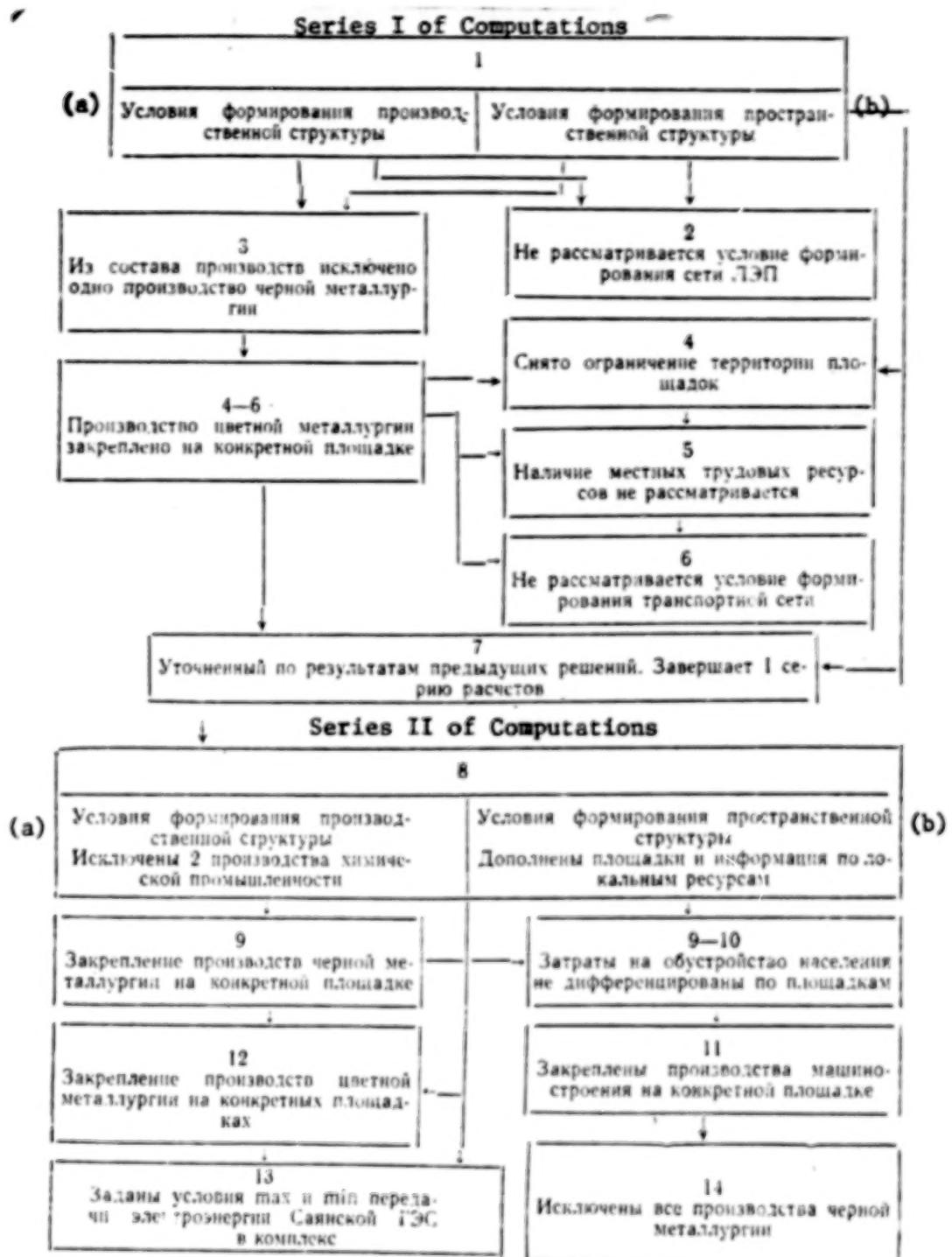
<u>Production Operation</u>	<u>Code</u>	<u>Series of Computations</u>	
		<u>I</u>	<u>II</u>
Electric Power Industry			
Electric power	GES, GRES, TETs	+	+
Heat	TETs	-	+

Table 2. List of Sites of the Sayan TPK (according to the variants of the calculations)

<u>Site</u>	<u>Industrial Center</u>	<u>Series of Computations</u>	
		<u>I</u>	<u>II</u>
Mokhovskaya	Abakan-Chernogorsk	+	-
Tashebinskaya	Abakan-Chernogorsk	+	+
Podsinenskaya	Minusinsk	+	-
Minusinsk	Minusinsk	+	+
Tesinskaya	Minusinsk	+	+
Kuragino	Kuragino	+	+
Askiz	Askiz	+	-
Kirbinskaya	Kirbinskiy	+	+
Oznachennoye	Sayanogorsk	+	+
Luk'yanovskaya	Sayanogorsk	-	+
Shunerskaya	Sayanogorsk	-	+
Kop'yovo	Northern zone of the Sayan TPK	-	+
Terskaya	Northern zone of the Sayan TPK	-	+
Komsomol'skiy	Northern zone of the Sayan TPK	-	+
Krasnoturanskiy	Northern zone of the Sayan TPK	-	+

The first series of computations was made so as to take into account incomplete information on conditions of the territory of the TPK. Such a situation is possible when problems are being solved related to shaping the spatial structure of a TPK in regions being developed for the first time. The second series of computations reflects more fully the conditions of the territory in terms of specific indicators. In all 14 variants of the calculations were examined, 7 variants in each series. The variants are distinguished by changes in particular conditions, which are dictated either by a revision of the initial data or by supplementation of the initial data (Scheme 1). In the second series of computations there was the problem not only of shaping the spatial structure of the TPK, but also of determining the possible size of the population and of discovering the needs of the population (on a par with industry) for the resources of the TPK (land, water, heat, electric power).

Scheme 1. Variants of the Calculations of the Spatial Structure of the Sayan TPK



Key: 1a. Conditions for formation of the production structure
 1b. Conditions for formation of the spatial structure

Key to Scheme 1 (continued)

2. The condition of formation of the long-distance electric power transmission network is not taken into account
3. One production operation of ferrous metallurgy has been omitted from the production operations
- 4-6. The production operation of nonferrous metallurgy is assigned to a specific site
4. Limitation on the area of the sites is removed
5. Availability of local labor resources is not taken into account
6. The condition of formation of the transportation network is not taken into account
7. Revised on the basis of the results of the previous solutions. Series I of the calculations is completed
- 8a. Conditions for formation of the production structure. Two production operations of the chemical industry omitted
- 8b. Conditions for formation of the spatial structure. Addition to sites and to information concerning local resources
9. Assignment of production operations of ferrous metallurgy to specific sites
- 9-10. Costs of providing amenities for the population not differentiated by sites
11. Production operations of machinebuilding assigned to a specific site
12. Assignment of production operations of nonferrous metallurgy to specific sites
13. Conditions of maximum and minimum electric power transmission of the Sayanskaya GES to the complex given
14. All production operations of ferrous metallurgy omitted

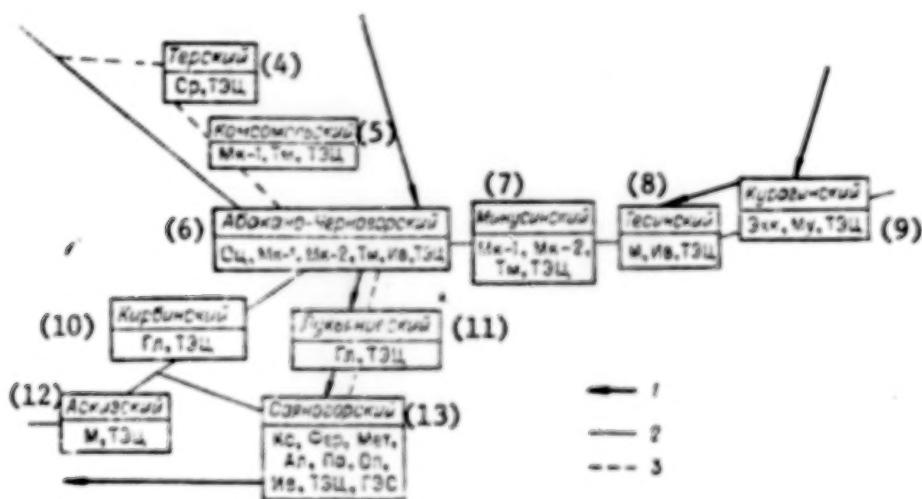
Analysis of the data obtained reveals the tendencies in the shaping of the spatial structure of the Sayan TPK in Phase II of its creation. They arise on the one hand from the specific nature of the complex's production structure and on the other from the peculiarities of its territory. The spatial structure is shaped under the impact of a number of factors and conditions whose effects are either supplemental to one another or go in different directions.

The spatial structure of the Sayan TPK, according to the results of the solutions, is being shaped on the basis of the following industrial centers: Abakan-Chernogorsk, Minusinsk, Sayanogorsk, Kuragino, Tesinskiy, Kirbinskiy, Luk'yanovskiy, Askiz, Terskiy and Komsomol'skiy (Scheme 2, Table 3).

The Abakan-Chernogorsk industrial center is now developing at the fastest pace. Very large enterprises in light industry and the food industry and transport machinebuilding have built here and are now under construction, and a very important construction capability is being built up. By 1980 its formation will by and large be completed. The calculations showed that the structure of the center may in future be supplemented by production

operations for processing ferrous metals. From results of other solutions, however, it is assumed that production operations in the chemical industry, nonferrous metallurgy and ferrous metallurgy are to be located in the Abakan-Chernogorsk industrial center (Table 3). Assuming only enterprises of machinebuilding are located here, the center still has a certain reserve area available for industrial and public works construction, which could be used for the subsequent development of the center subsequent to Phase II.

Scheme 2. Spatial Structure of the Sayan TPK, Synthesized From the Results of the Computations



Key:

1. Direction of electric power flows from the unified power system
2. Existing transportation network
3. New sections of the transportation network
4. Terskiy; Sr, TETs (The code symbols of the production operations are the same as those given in Table 2.)
5. Komsomol'skiy; Mk-1, Tm, TETs
6. Abakan-Chernogorsk; Ots, Mk-1, Mk-2, Tm, Iv, TETs
7. Minusinsk; Mk-k, Mk-2, Tm, TETs
8. Tesinskiy; M, Iv, TETs
9. Kuragino; Ekhk, Mu, TETs
10. Kirbinskiy; Gl, TETs
11. Luk'yanovskiy; Gl, TETs
12. Askiz; M, TETs
13. Sayanogorsk; Ks, Fer, Met, Al, Pa, Op, Iv, TETs, GES

The Minusinsk industrial center is also taking shape at the present time. Its nucleus is the electrical equipment complex of machinebuilding plants, and certain enterprises in light industry and the food industry have been built and are under construction. Its future development has both its advantages and shortcomings. One of the inhibiting factors on its development is the limited nature of available area. The Minusinsk industrial

center is located in a zone of the complex's productive farmland, and therefore sites available for industrial and public works construction are of limited size. Other conditions and resources are analogous to those of the Abakan-Chernogorsk industrial center. With respect to most of the variants of the solutions machinebuilding should be located in Minusinsk. The Minusinsk industrial center, like the Abakan-Chernogorsk industrial center, will become a center of the Sayan TPK for machinebuilding. In the more remote future it is possible that a large agglomeration will come into being on the basis of these two industrial centers.

Table 3. Frequency of Selection of the Variants of Location of Production Operations

<u>Industrial Center</u>	<u>M</u>	<u>Met</u>	<u>Ka</u>	<u>Fer</u>	<u>Gl</u>	<u>Al</u>	<u>Pa</u>	<u>Ots</u>	<u>Ekhk</u>	<u>Iv</u>	<u>Mu</u>	<u>Op</u>	<u>Mk-1</u>	<u>Mk-2</u>	<u>Tm</u>	<u>Sr</u>
Abakan-Chernogorsk	4	1	2	1	1		6	1	3	1		6	6	6		
Minusinsk									1	1		3	3	3	6	
Kuragino			2	1		2			6	13		1				
Tesinskiy	2	4	3	3						3						
Askiz	2	2	1	1						2			1			
Sayanogorsk	5	10	11		11	6	1			3	4					
Kirbinskiy					7	1										
Luk'yanovskiy						4					3					
Terskiy							3	4				1			7	
Komsomol'skiy												3	2	3		

Note: The numbers 1-14 represent the number of variants of the calculations in which the production operation is located at the given site.

The Sayanogorsk industrial center is just beginning to take shape. The results of this solution showed that this center will be a focal point for energy-intensive production operations in ferrous and nonferrous metallurgy. A plastics processing operation is also being located in the center. Even though the results of the solution show that the center will accommodate large production operations requiring large grounds and a certain health-safety zone, reserve areas will still be available for its future development. At present the direction and scale of the center's development after 1990 are not obvious. One thing is clear that even in Phase II of creation of the Sayan TPK the Sayanogorsk industrial center could become one of the most important centers in the complex. The water resources of the Yenisey are practically unlimited here, and the cost of their utilization is not high. But the microclimatic conditions in the area of the center are not altogether favorable for building a large city. These conditions were taken into account in certain variants of the calculations (12-13), which had an impact on location of labor-intensive production operations. For instance, production operations in the machinebuilding industry would be inclined toward the Sayanogorsk industrial center, but the conditions of restricted urban development prove to be a restraining factor, and the machinebuilding enterprises are located in the north of the TPK. Should a city be located

on the right bank of the Yenisey, the possibilities for the center's development will increase.

The production operations located in the center require large amounts of electric power. The capabilities of the Sayano-Shushenskaya GES in terms of base output of electric power are limited. But this does not affect the location of these production operations, since power will be supplied through the OES [Unified Siberian Power System].

The existence of large reserve areas for construction of projects and comparatively low costs of land use have already had a large impact on location of production operations in the Sayanogorsk industrial center.

The alumina production operation is located primarily to accommodate the transport factor, i.e., at sites located closer to an access to the complex of alumina-containing raw materials, though in view of its technological connections it also gravitates toward aluminum production.

On the basis of the results of solving the problem for all the variants, alumina production is located either at the Luk'yanovskaya site or the Kirbinskaya, that is, in the immediate vicinity of the Sayanogorsk industrial center so as to bring it closer to the input of alumina-containing raw materials. The Luk'yanovskaya site proved to be the most attractive for this production operation, since it is of considerable size and is located closer to the Yenisey. Later this site might be regarded as a reserve site for development of the Sayanogorsk industrial center, or an independent industrial center might spring up here.

The Askiz industrial center is not undergoing extensive development according to the results of the variant calculations (Series I). By and large the Askiz site is competing with the Tesinskaya site for location of the enterprises of ferrous metallurgy. In various variants of the computations production of synthetic fiber and machinebuilding are located at Askiz. There are a number of factors favoring and inhibiting the formation of this center that could explain this. Askiz is a transportation junction, but the size of its site is limited. Nor is its configuration conducive to the placement of a number of large production operations together. The water resources of the site (the river Abakan) can be taken as practically unlimited, just as at the site located along the Yenisey.

But the Askiz industrial center will still develop, but not by virtue of large-scale production operations of ferrous metallurgy. Enterprises involved in lumber and timber processing have been located here. There are plans to build a plant for industrial asbestos products using Tuva asbestos. A factory is being built to enrich the iron ores of the deposits of the Sayan TPK. A number of projects of light industry and the food industry have also been built at Askiz or are under construction. On the whole this center can be regarded as a reserve for development of the Sayan TPK after 1990.

The Kuragino industrial center may be shaped on the basis of the site located near the settlement of Kuragino. This site, according to the results of the solutions, turned out to be attractive for the power-intensive production operations in electrochemistry and the fertilizer industry. The energy and transport factors proved to be the principal ones in location of these production operations. The site is located near access to a complex of energy raw materials (a trunk long-distance transmission line of the OES, running eastward, will pass through here), and it is also near the Abakan-Tayshet railroad. The area of the site is rather large and it has water resources for location of chemical production operations. But Kuragino's location in a zone of the most productive farmland is one of the factors restraining further development of the industrial center, which indeed was taken into account in shaping the variants of location of production operations which have harmful emissions and effluents.

The Tesinskaya site, like the Askiz site, is attractive for location of the production operations of ferrous metallurgy according to the results of the variant computations (Series I). But these calculations did not examine in detail the local conditions of the site's area, such as, for example, the use and annexation of farmland (the most productive farmland in the TPK) for industrial construction and the conditions of water intake and sewer system on the Tube River, which must be taken into account in location of these production operations. The results of the second series of calculations showed that the Tesinskaya site proved less efficient for their location, since these conditions were taken into account. It can be looked upon as a reserve for development of the Minusinsk industrial center, provided that the production operations of machinebuilding are located here.

The sites in the northern zone of the TPK--the Terskaya and Komsomol'skiy sites, proved to be efficient for location of a number of production operations with respect to other positive factors in spite of the lack of rail access to them. These sites could become a center of machinebuilding in the Sayan TPK. At the present time they are unoccupied. The sites are located close to the Central Krasnoyarsk TPK, and in subsequent stages of development of the complex they could become a connecting link between the Sayan TPK and that other complex. The advantages of the sites are obvious: the center's large area and low specific costs for land development, the availability of water resources (Yenisey River), low costs for water supply and disposal as compared to a number of other sites of the Sayan TPK. They are also located closer to access to a complex of main long-distance transmission lines of the OES. Pioneer development of this zone in the form of major industrial projects requiring construction of a railroad would enhance the significance of this zone as a reserve for future development of the Sayan TPK. In a number of variants of the computations, aluminum production is located at the Terskaya site, and by and large machinebuilding enterprises are gravitating toward the Terskaya site. At the present time the factors standing in the way of development of these sites is also their remoteness from the principal construction capabilities of the TPK (Abakan, Minusinsk and Sayanogorsk). But the construction capability of the Achinsk

industrial center, which in future will become available, could take over development of this zone of the complex.

Thus solving the problem for all the variants of the computations showed that in Phase II of the formation of the Sayan TPK there is a realistic possibility for formation of five industrial centers, three of which are now taking shape. Approximately 70 percent of the population of the complex will be concentrated at those industrial centers. The industry and population of those centers comprise 93 percent of the total need for electric power of the entire TPK.

The spatial structure of the TPK means more than merely the scheme for location of production operations and the system of industrial centers; it is also the system of production and social relations among them, which make it possible to unify the production operations into a unified complex. It is unthinkable that these relations can be accomplished without creating and developing the infrastructure of the complex (both lines and points) both of the complex as a whole and also of its various industrial centers. That is why the infrastructure, which is an element in the economy of the TPK, determines its spatial structure.

Two elements of the production infrastructure of the complex as a whole were taken into account in the problem: the transportation network and the network of power transmission lines for distribution within the complex. An analysis of the computations gives an idea of the direction and degree of impact of the factors of the infrastructure on location of production operations and on formation of the production structure of the industrial centers. The direction and degree of development of the individual elements of the infrastructure depend in turn on the trend in location and functioning of particular production operations and on the distribution of the population as the spatial structure of the TPK takes shape.

The variant of formation of the transportation network of the complex obtained as a result of these computations includes a network of 12 sections joining the industrial centers included in the plan, including 5 sections yet to be built. Two sections will give access to the city of Abakan from the Sayanogorsk industrial center. Should industrial centers be created in the northern zone of the TPK, it will be necessary to build three sections of the transportation network joining the Terskaya and Komsomol'skiy sites with the other sites of the complex. On the whole the present transportation network, which has some spare carrying capacity, has had a substantial impact on the shaping of the spatial structure of the Sayan TPK. All the industrial centers, according to the results of the computations, are linked up by the present network of rail lines and highways, and some of them by waterways as well.

The preparedness of the Sayan TPK from the transportation standpoint is also evident from the proportional breakdown of costs in the second phase of formation of the complex. For instance, development of transportation will

require 5 percent of all outlays to build and operate industrial and public works projects.

Solving the problem for all the variants showed that the new production operations to be built considerably augment the flows of freight between industrial centers within the complex. The volume of transshipment within the complex will increase by approximately 30 percent, which means bolstering certain sections of the transportation network.

The Unified Power System takes shape in the problem on the basis of the main long-distance power lines and major sources of power. The Sayano-Shushenskaya GES, the KATEK [Kuybyshev Motor Vehicle and Tractor Electrical Equipment and Carburetor Plant] group of GRES's and the new TETs's in each industrial center being shaped were taken as the sources of power for the Sayan TPK. The main power transmission lines were supposed to be those transmitting electric power to the complex from outside power sources. Distribution power transmission lines between the industrial centers being shaped within the complex are determined as a result of solving the problem. Calculations made it possible to obtain a variant of the development of the electric grid within the complex, which is shown in Scheme 2. For instance, all available electric power of the Sayano-Shushenskaya GES is distributed to the Sayanogorsk industrial center for nonferrous and ferrous metallurgy. A certain flow of electric power from outside power sources is also sent there. Electric power reaching the TPK from the west remains partly at the Abakan industrial center and the remainder goes to the Minusinsk industrial center along the distribution network of the complex. Power is transmitted from the east to the Kuragino industrial center. Should the Tesinskiy industrial center be shaped in the future, it will be supplied with electric power over the distribution network from Kuragino. According to the results of the variant calculations (8-14) the production of fertilizers is located at Kuragino. In this case the building of a TETs at the site will completely cover (in this stage of its formation) the center's need for electric power and heat.

Development of machinebuilding in the northern zone of the TPK does not require additional construction of power distribution lines--it will be adequate to build the TETs's within the centers. Should aluminum production be located at the Terskaya site it will be necessary to bring a main power transmission line from the west. The power network of transmission lines within the complex, like the transportation network, depends on the location of production operations and on the production structure of the industrial centers, and at the same time its formation has an impact on location of those production operations. The variant obtained for the power network within the complex supplements and imparts greater precision to the scheme of the OES (southern part of the Angara-Yenisey region).

Calculations of the shaping of the spatial structure of the Sayan TPK in Phase II of its development showed that a change in certain conditions of the problem affects the scheme for location of production. But the impact

of the factors (direction and intensity) determining its development is stable. The conclusions therefrom are these:

1. Power-intensive production operations are located at sites where conditions for the supply of power afford cost savings. Thus for most of the variants of the computations the production of aluminum and rolled products, quality steels and ferroalloys is located at the Sayanogorsk industrial center, and the various production operations in these industries compete for this site. Moreover, in selecting the place for location of power-intensive production operations there are also other factors and conditions that play a role. For instance, the Kop'yevo site is located along the Achinsk-Abakan railroad and is closer to the flow of electric power from the KATEK GRES than the Terskaya site, but the shortage of water reserves and higher costs for use of land make the Terskaya variant preferable. The same can be said of selecting the site for the power-intensive production operations of ferrous metallurgy. In the first series of calculations the Tesinskaya and Askiz sites competed with the Oznachennoye. In the second series of calculations, where utilization of the resources of the local area (land and water) were taken more fully into account as conditions, the Oznachennoye variant became preferable.

Location of the electrochemical industry proved on the whole to be stable in spite of the change in conditions. This production gravitates toward the Kuragino site in five of the seven variants of the calculations.

2. Materials-intensive production operations depend as a rule on the existence of a transportation network between the sites they gravitate toward. Production operations in ferrous metallurgy regularly vary between the Tesinskiy and Askiz industrial centers (Series I). The Tesinskaya site is closer to the input of flows of iron ore, and the Askiz site is closer to the flow of coke. In only one variant of the 14 variants of the calculations was fertilizer production located at the Mokhovskaya site of the Abakan-Chernogorsk industrial center; in all other cases preference was still given to the Kuragino variant for location. The decisive role is played by the fact that that site has transportation giving it access to the raw materials and an outlet for the finished products.

The production of alumina is located close to aluminum production, but closer to the point where the raw material enters the complex. These points prove to be the Kirbinskaya (Series I) and Luk'yanovskaya (Series II of the computations) sites. The local conditions of the Luk'yanovskaya site are more efficient than those of the Kirbinskaya, which is why the Luk'yanovskaya variant for location of alumina production turned out to be preferable in the second series of computations in spite of the need to build new sections of the transportation network.

Production of synthetic fiber, though, proved to be freer than all other production operations with respect to choice of location. But an analysis of the results of the solution showed that even here a definite tendency is

preserved. Synthetic fiber enterprises are located as a rule at those industrial centers where there is an available reserve of heat, which must be produced by the TETs to meet the needs of other production operations. For example, the production of synthetic fiber gravitates toward the Abakan-Chernogorsk and Sayanogorsk industrial centers and the Tesinskaya and Askiz sites, i.e., where a large total need for electric power is created.

3. Production operations in machinebuilding, according to all the calculations, mainly vary their location from one to the other of two industrial centers: Abakan-Chernogorsk and Minusinsk (variants 1-9), i.e., where there is a certain reserve in terms of the social and residential infrastructure built in Phase I of the complex's development. Removal of the condition of cost differentiation to furnish amenities for the public at the sites would immediately bring production operations of machinebuilding to the Komsomol'skiy and Terskaya sites, where the costs of using local resources are lower. The condition that is limiting the growth of population of Abakan and Sayanogorsk also affected the variant in which the production operations of machinebuilding are located at sites in the northern zone of the TPK (variants 11-14).

Correction of the makeup of the production operations planned for development of the Sayan TPK in the second series of the calculations did not have any essential impact on formation of its spatial structure; the tendency in its formation remained the same.

FOOTNOTES

1. "Modelirovaniye formirovaniya territorial'no-proizvodstvennykh kompleksov" [Simulating Formation of Regional Industrial Complexes], Novosibirsk, Nauka, 1976, 334 pp.
2. "Formirovaniye territorial'no-proizvodstvennykh kompleksov Angaro-Yeniseyskogo regiona" [Shaping the Regional and Industrial Complexes of the Angara-Yenisey Region], Novosibirsk, Nauka, 1975, 174 pp.

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Sayan Regional Industrial Complex

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA
OBSHCHESTVENNYKH NAUK in Russian No 6 (15 times a year), May 79 pp 9-14

[Article by M. K. Bandman and M. A. Malinovskaya, Institute for the Economics and Organization of Industrial Production of the Siberian Department of the USSR Academy of Sciences, Novosibirsk]

[Text] Formation of the Sayan regional industrial complex (TPK) began in the Ninth Five-Year Plan. The favorable natural and climatic conditions of this region, the possibility for development of agriculture on a large scale, the convenient economic-geographic position, and the infrastructural preparedness of the area made its creation advisable.

The issues involved in shaping the Sayan TPK have been a topic of extensive discussion at the most important scientific conferences concerning development of Siberia's industrial forces and in scholarly publications.¹ In accordance with the conception worked out by the Council for the Study of the Productive Forces of USSR Gosplan in the fifties and sixties, it is advisable to develop the following with the Sayan TPK: first, power-intensive production operations of nonferrous and ferrous metallurgy; second, labor-intensive production operations: machinebuilding--to meet the needs of Siberia, and light industry and the food industry--to attract the reserve of female labor resources into the sphere of material production; third, agriculture and transformation of the Sayan TPK into a most important supplier of agricultural products to Eastern Siberia.

In the sector for formation of the TPK of the Institute for the Economics and Organization of Industrial Production of the Siberian Department of the USSR Academy of Sciences research has been done for a number of years on this complex by means of the method of mathematical-economic simulation.²

A series of computations have been made to optimize the Sayan TPK's production and spatial structures up to the year 2000. The results of these computations have been partially set forth in the previous issue of the journal IZVESTIYA SO AN SSSR.³ Our research confirms the basic principles of the conception worked out by the Council for the Study of the Productive Forces, which was the basis for the formation of the Sayan TPK in the first phase of its creation (the years of the 9th and 10th 5-year plans). But an analysis of the process of the complex's formation in that phase showed that a number of organizational problems have to be solved to carry out this program for development of the complex in the 11th Five-Year Plan. These are ensuring the optimum schedule and volume of financing construction of the complex's projects and the preferential development of construction capabilities, raising the rates of development of the social and residential infrastructure and agriculture, and optimum utilization of natural resources. The Sayan TPK has only begun to be built, and unlike the Bratsk--Ust'-Ilimskiy TPK, for which the 11th Five-Year Plan will define the prospects of the

second phase of its development, in the Sayan TPK the 11th Five-Year Plan may be the 5-year plan for eliminating "difficulties in growth" and for planned completion of the first phase of its formation. A long-range plan for development of the TPK also needs to be drafted and approved.

By contrast with a number of promising TPK's, the Sayan complex is taking shape in a region which already occupies an important place in the economy of Krasnoyarskiy Kray: its relative share in the output of certain industries in the kray is approximately one-third, it is even more than one-half of the output of light industry and the food industry, and in the agricultural sector its share ranges between 30 and 70 percent depending on the product. Back in the Eighth Five-Year Plan major projects of light industry and the food industry began to be built within the complex. The years of the Ninth Five-Year Plan can be taken as the beginning of the regional industrial complex's formation.

At the present time the country's largest GES, the Sayano-Shushenskaya, is being built within the complex, and its first unit has already been supplying commercial power; the Abakan Railroad Car-Building Complex is under construction, and its first output--large-load flatbed cars--have already gone to the country's railroads; construction has begun on the Sayansk Aluminum Plant; construction is under way on the first three plants of the Minusinsk complex of the electrochemical industry--the country's first complex to unify 13 interrelated enterprises located in one city. In the Sayan TPK there have been built or are under construction large enterprises in light industry (Minusinsk Glove Factory, Chernogorsk Iskozh [artificial leather] Plant, Chernogorsk Worsted Fabric Combine, etc.), ferrous metallurgy (Krasnokamenskiy and Irbinskiy mining and ore-dressing combines), the building materials industry (Sayansk Stone Products Plant) and projects in other industries. As a result the Abakan-Chernogorsk, Minusinsk and Sayanogorsk industrial centers are taking shape within the Sayan TPK. But as the complex is built, there is not sufficient coordination in the development of the individual elements of the economy; the scale and pace of creation of the principal projects are determined by the plans of various sectors and industries without sufficient intersector and interindustry linkage within the complex. Moreover, infrastructural projects common to the entire complex and to each of the industrial centers as a whole are becoming the most vulnerable part of the economy of the TPK.

The history of the creation of the Sayan TPK has shown that deadlines have been missed and volumes of financing have been amended in construction of the principal projects. Some ministries and departments either cut back on their annual appropriations, or they move commencement of construction of projects outlined in the program to later dates. Sometimes the conception of specialization of the projects under construction changes, or there is a change in the order in which particular products are produced. This disrupts synchronization of construction both of the industrial facilities themselves and also of projects which have intersector significance and significance to the entire industrial center (the industrial infrastructure

and the social and residential infrastructure). For example, when the railroad car-building plant was located in the Abakan-Chernogorsk industrial center, it was planned that a number of facilities of the industrial infrastructure would be built on the basis of shared participation (the TETs, the heat distribution system, and so on) together with the plant for the manufacture of nonferrous metals. But the dates for construction of the latter plant were postponed indefinitely. As a result the railroad car plant had to build the entire infrastructure needed on its own.

Failure to meet deadlines for construction of the principal facilities causes certain complications in organizing the construction capabilities of the complex. The bulk of the construction work in the Sayan TPK is done by organizations of the Ministry of Heavy and Transport Machinebuilding and the Ministry of Power and Electrification. The capacity of construction organizations is inadequate to handle the entire volume of work. There is no coordination in their activity, though sometimes they are working on a single industrial facility in one and the same industrial center. In any particular year one construction organization may not be able to handle the volume of work that occurs along with the sharp rise in appropriations, while at the same time the construction workers of the other construction capabilities are not fully utilizing their capacities.

There is no question that the constructed experience in forming the Bratsk--Ust'-Ilimsk TPK and the role which Bratskgesstroy [Organization for Construction of the Bratskaya GES] played in that process provides the basis for raising the question of unifying all construction personnel (Glavkrasnoyarskstroy first of all) into one organization or of creating right within the complex a body which would coordinate the work of all construction organizations in the TPK. A large association would have high maneuverability (would be less dependent on fluctuations in the financing of the various projects), and would be able to plan development and solve staffing problems. The association would make it easier to solve many "current" problems which arise when a single industrial center is being built by two construction capabilities (as is the case in Sayanogorsk).

The inadequate supply of building workers could become a serious limitation on the scale of construction in the Sayan TPK. Even now fulfillment of plans and use of the material and technical base of construction organizations that has been created are in large part determined by the inadequate number of construction workers. This problem cannot be solved without planned prior training of construction workers and without providing them housing, children's institutions and other facilities that are part of the social welfare and residential infrastructure. This is especially important to the Sayan TPK, since in coming years there will be a substantial increase in the number of jobs at new plants (including enterprises with higher wages--the aluminum and other plants), which will step up even more the turnover of construction workers unless construction organizations are provided facilities that make up the social and residential infrastructure and unless the qualifications of construction workers guarantee them high remuneration.

The absence of a long-term plan for development of the TPK is being manifested particularly in the development of infrastructural facilities of social and industrial importance pertaining to the entire complex and to each of the industrial centers as a whole. If the Sayan TPK is to some extent prepared in terms of the infrastructure of the entire economy (the existence of a sufficiently ramified transportation network), facilities making up the social and residential infrastructure are being built with a very sizable lag behind the startup of industrial facilities. The low effectiveness of the present mechanism for monitoring the financing and fulfillment of plans by ministries for construction of the facilities of the social welfare and residential infrastructure is tending to form a large shortage of housing, children's institutions and the service sphere. That is why enterprises and especially construction organizations cannot recruit the number of workers they need even though there are a great number of people who want to take part in building the Sayan TPK. This is tending to lengthen periods for attainment of rated capacity at the principal industrial facilities and causing underutilization of up-to-date equipment and capacities of construction organizations. As a result advantage is not being taken of the unique advantage of the south of Krasnoyarskiy Kray, and doubt is being cast on the unquestionably correct thesis to the effect that one of the principal prerequisites for formation of the Sayan TPK is the existence of favorable conditions for life of the population and for attracting and holding personnel.

Thus the development of the social and residential infrastructure, improvement of the living conditions of the population, creation of conditions for attracting workers from the country's other regions and keeping personnel in the complex's agriculture are the most important conditions for formation of the TPK, and they are interrelated. Their fulfillment is in large part crucial to the possibility and effectiveness of carrying out the principal task of creating the Sayan TPK--transforming the south of Krasnoyarskiy Kray into a new region of labor-intensive subindustries of machinebuilding and into a large agricultural base in the east of the country.

The complex's present agriculture is still not producing the necessary assortment and quantity of agricultural products. Enhancement of agriculture's role as a leading sector of the Sayan TPK's specialization necessitates sizable capital investments both to intensify agricultural production itself and also to develop related industries.

The Siberian Department of VASKhNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin], jointly with agricultural authorities and the planning commission of Krasnoyarskiy Kray, has determined the realistic scale for development of agriculture of the Sayan TPK in the years of the 10th Five-Year Plan. It is proposed that the specialization of the complex's agriculture continue and that animal husbandry remain its leading branch. The need to build a strong agricultural base in the kray is obvious, since without this it is difficult to solve many problems of the national economy related to using the natural resources of Siberia. It is important in this connection to take into account a number of initial principles

resulting from the significance and specific conditions for development of agriculture of the Sayan TPK.

1. Without the agriculture of the Sayan TPK it will not be possible to meet the needs for many of the most important foodstuffs within the Angara-Yenisey region as a whole and in Krasnoyarskiy Kray in particular; that is why in defining the direction and scale of development of the complex's agriculture it is indispensable to aim at a sizable export. It is impossible to estimate the adequacy of farm products reaching the population of the complex solely on the basis of total production (without taking into account deliveries outside the TPK and the kray), thereby making the problem less acute and reducing assignments for production of farm products.
2. The necessary volume of production of agricultural products in the Sayan TPK cannot be obtained unless the sector is converted to the agroindustrial type of organization of production, without retooling, without extensive co-operation with industry, without a sharp increase in the amount of fertilizer applied, without expansion of the area of irrigated land, and without pursuing other directions in the intensification of production.
3. The development of agricultural production requires a thrifty attitude toward farmland resources. They need to be reassessed and confiscation of agricultural land for industrial, transport and urban construction and other forms of nonfarm use reduced to a minimum. It is important to take into account in this connection not only the outright confiscation of land, but also the possibly adverse effect of industry on yield, productivity and other indicators of agriculture in the zones where harmful emissions or effluents are disseminated.
4. Staffing agriculture could be one of the important problems of the sector's development with the Sayan TPK. It has two aspects. On the one hand, industrialization and intensification of agricultural production necessitates that a large number of workers go through retraining, improve their qualifications and learn new occupations. On the other hand, the creation of a large number of new jobs at new enterprises in the cities of the complex (including industries which have higher pay) will unquestionably intensify the flow of people out of rural areas. This is a natural process, and one must be prepared for it. It is important to eliminate the random element and see that the interests of all sectors of the economy can be taken into account in the redistribution of labor resources. Managing the process of migration of the rural population is impossible until the organization of work, working conditions and living conditions of the population are improved. Otherwise the conditions for intensification of agricultural production cannot yield the desired results. The danger of losing a portion of the able-bodied farm population from the agriculture of the Sayan TPK is altogether realistic. Even now one of the serious problems is to find ways of staffing agriculture.

Development of agricultural production will determine the specialization of production operations of the food industry and light industry related to it. A number of such production operations have been built within the Sayan TPK. But the major enterprises of light industry which have been built (the Minusinsk Glove Factory, the Chernogorsk Worsted Fabric Combine, the Iskozh Plant, etc.) are not based on local agricultural raw materials, but on raw materials brought in from somewhere outside the complex. Their location was dictated by the "necessity" of utilizing female labor (second members of families who are unemployed). Experience has not confirmed this initial hypothesis for the following reasons: first, the multisector production structure of the Sayan TPK which has been created (above all machinebuilding) and the service sphere are attracting a sufficient number of women into the sphere of social production; second, the forecast of the number of those wishing or actually able to go into the sphere of material production proved to be erroneous. Thus creation of production operations "to utilize second members of the family" made it more complicated to solve the problem of furnishing labor resources to other sectors of the economy.

By contrast with certain promising TPK's of the Angara-Yenisey region, the Sayan TPK is not distinguished by its raw material resources. The deposits it has of various mineral raw materials are not unique (in their composition and especially their reserves), but they are located in a region that is fairly settled and is developed from the transportation standpoint, they have been well studied, and they are ready for industrial development. In this case we are talking about those resources for which a need could arise in coming years, perhaps in the 11th Five-Year Plan.

For example, the prospects for development of the coal industry on the basis of the Minusinsk basin as a rule has been linked solely to meeting the needs of permanent consumers who have already committed themselves. At the present time there is a basis for reassessing these premises and examining the question of the use of Minusinsk coal along with the problems of shaping KATEK and of transforming the Kuzbass into a large supplier of energy coal to the regions of the European part of the country and the Urals which have a fuel shortage.

Another example might be the question of using deposits of raw materials for the production of manufactured fertilizers needed by agriculture of the Sayan TPK. Construction of the fertilizer plant was provided for in many projections of development of the productive forces of the south of Krasnoyarskiy Kray. But so far nothing has been done about this in practical terms.

Thus a study of the first stage of formation of the Sayan TPK offers grounds for saying on the whole the specialization of the complex was correctly defined and will be retained in the future during the 11th Five-Year Plan. Moreover, the role of machinebuilding in agriculture is increasing, and the position of the electric power industry and power-intensive production operations is stabilizing somewhat.

But the way in which the Sayan TPK has developed in the 9th and 10th 5-year plans has demonstrated that in spite of the sufficiently thorough preplan preparation of the prospects for its development and the attention paid to the complex by central and local party and soviet administrative agencies, there is reason to suppose that completion of the first stage of creation of the Sayan TPK may occur after the 11th Five-Year Plan. As a result many sources for increasing the efficiency of utilization of resources and for taking advantage of the specific conditions for development of the productive forces of the south of Krasnoyarskiy Kray, which are unique to Siberia, will in the end be underutilized.

Obviously we are not talking about isolated breakdown of linkages. Judging by the press, many shortcomings in formation of the Sayan TPK are also typical of the process of evolution of the country's other TPK's (Southern Tadzhik, Middle Ob', Pavlodar-Ekibastuz, etc.). It seems to us that a large portion of them result from the imperfectness of the system of planning and management of the process of formation of the TPK. It is therefore indispensable to create the following: 1) a system for preplan preparation, project preparation and planning that is unified for all the TPK; 2) a mechanism that guarantees that ministries fulfill their obligations in accordance with the plan for creation of the TPK which has been approved and previously cleared with all interested organizations (this especially applies to complexwide facilities of intersector importance); 3) a mechanism that guarantees that the plan is fulfilled on time with respect to the makeup, scale and completion time of infrastructural facilities; 4) a system for managing the process of formation of the TPK.

The drafting of the following can be taken as priority steps whose accomplishment is important to successful completion of the first stage of formation of the Sayan TPK:

- 1) the master chart for development and location of the productive forces of the TPK and its transformation into an official document defining the goals and prospects of the complex over the entire period of its formation;
- 2) the program for formation of the TPK and its inclusion as an integral, but independent, part of the program for development of the productive forces of Krasnoyarskiy Kray in the period 1980-1990;
- 3) 5-year and annual plans for creation of the Sayan TPK which straightforwardly indicate the volume of capital investments for each project, their distribution by years and by purpose (principal production operation and infrastructure); we look upon plans for creation of the TPK as an integral part of the relevant plans of the country and of Krasnoyarskiy Kray;
- 4) a system of measures guaranteeing formation of stable personnel, effectiveness in attracting labor resources and optimality in redistribution of labor resources among the sectors of the economy and between urban and rural areas.

Particular attention must be paid to organizing agencies for managing the process of formation of the Sayan TPK. From the standpoint of management the Sayan complex is in the most unfavorable situation of all the TPK's of the Angara-Yenisey region. Not only do communications break down between departments, but also between areas within the complex. The left-bank part of the complex is a part of the Khakasskaya Autonomous Oblast. Soviet administrative and party authorities of the Khakasskaya Autonomous Oblast are taking steps to monitor and coordinate economic development, but only on the left bank. On the right bank there is a group of rayons of Krasnoyarskiy Kray, each of which is directly subordinate to the authorities of the kray. Not only are the right-bank rayons lacking communication in this respect with the left-bank rayons, they do not even have communication among themselves.

Thus one of the important conditions for fulfilling the tasks of the 11th Five-Year Plan concerning creation of the Sayan TPK is to solve the problem of management of that process. A management agency is needed on the spot for responsive solving of problems, and it is needed at the center to coordinate and monitor the activity of ministries and departments within the TPK.

FOOTNOTES

1. "Voprosy razmeshcheniya proizvodstva v SSSR" [Problems in Location of Production in the USSR], Moscow, Nauka, 1965; "Ekonomicheskiye problemy razmeshcheniya proizvoditel'nykh sil SSSR" [Economic Problems in Location of the Productive Forces of the USSR], Moscow, Nauka, 1969.
2. "Formirovaniye territorial'no-proizvodstvennykh kompleksov Angaro-Yeniseyskogo regiona" [Formation of Regional Industrial Complexes of the Angara-Yenisey Region], Novosibirsk, Nauka, 1975, pp 86-133.
3. Malinovskaya, M. A., "Variant Calculations of the Spatial Structure of the Sayan TPK," IZV. SIB. OTD. AN SSSR, No 1, 1979, SER. OBRNICHESTV. NAUK, Issue 1.

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CHANGES IN REGIONAL DISTRIBUTION OF SIBERIA'S INDUSTRIAL OUTPUT 1961-1975

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA
OBOSHCHESTVENNYKH NAUK in Russian No 6, May 79 pp 15-19

[Article by A. V. Tarasov, Institute for the Economics and Organization of Industrial Production of the Siberian Department of the USSR Academy of Sciences, Novosibirsk]

[Text] Until recently Eastern Siberia outstripped Western Siberia in growth rates of industrial production, which had the result of increasing its share in Siberia's industrial output from 35 percent in 1960 to 39 percent in 1970. During the Ninth Five-Year Plan the situation was changing--the average annual growth rate of the gross output of industry was higher in Western Siberia than in Eastern Siberia during that 5-year period (Table 1).

Table 1. Average Annual Growth Rate of Gross Industrial Output, in percentage

<u>Region</u>	<u>1961-1975</u>	<u>1961-1965</u>	<u>1966-1970</u>	<u>1971-1975</u>
Western Siberia	8.55	8.45	8.60	8.65
Altayskiy Kray	8.30	9.45	8.15	7.35
Kemerovskaya Oblast	6.50	7.25	6.65	5.65
Novosibirskaya Oblast	9.05	8.60	9.40	9.15
Omskaya Oblast	9.70	10.15	10.00	8.95
Tomskaya Oblast	7.10	7.55	7.40	6.40
Tyumenskaya Oblast	14.80	7.10	15.30	22.55
Eastern Siberia	9.35	9.95	9.70	8.50
Krasnoyarskiy Kray	9.95	10.65	10.65	8.60
Irkutskaya Oblast	9.15	9.95	9.00	8.45
Chitinskaya Oblast	6.90	6.20	6.80	7.75
Tuvinская ASSR	8.85	11.45	7.40	7.80
Buryat'skaya ASSR	9.15	9.15	10.10	8.30

The industrial sector of Western Siberia is characterized by greater fluctuations in annual increments of gross industrial output than is the case in Eastern Siberia, which can be explained by the closer link between Western

Siberia's industry with agriculture¹ (see Figure 1). As we see from Table 1, in most of the oblasts of Siberia there has been a decrease in the average annual growth rate from each 5-year period to the next. Exceptions are Tyumenskaya Oblast in Western Siberia and Chitinskaya in Eastern Siberia; we observe the fastest growth in the industry of Tyumenskaya Oblast.²

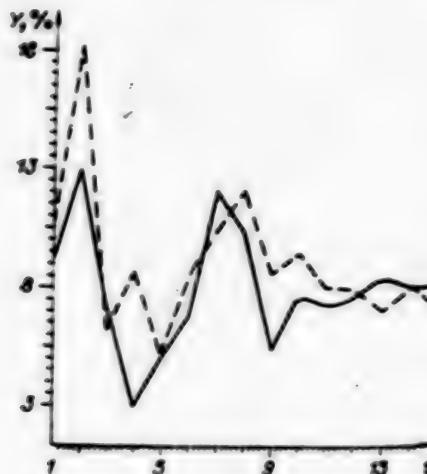


Figure 1. Rates of annual growth of the gross industrial output of Western and Eastern Siberia over the 1961-1975 period. — Western Siberia; --- Eastern Siberia; $t = 1, \dots, 15$; $t_0 = 1961$.

The average rate of growth is widely used in economic research as a summary index of the dynamic pattern; computing it is the simplest method of discovering the growth trend. The method of analytical smoothing is more refined in discovering the principal tendency.³ It consists of selecting that analytical equation which would most accurately describe the real tendency. The volume of production (Y) is then regarded as a function of a single variable--time (t).

A quadratic polynomial was chosen as the basic function of the growth of industrial output of Western and Eastern Siberia in the 1961-1975 period:⁴

$$Y = at^2 + bt + c.$$

In Table 2 are given the values of the coefficients a and b , their mean square errors S_a and S_b , the magnitudes by which the values of the coefficients of the equations of the trends exceed the mean square errors T_a and T_b , the correlation coefficients R , the average value \bar{Y} of the indicator being studied, the deviations S_y from the average value and the values of the standard error of estimate S_{est} of the equations of the trends. The values of the constant c , since they have no economic interpretation, are not given.

Table 2. Basic Statistical Characteristics of Regression Equations Approximating the Growth of the Volume of Siberia's Industrial Output 1961-1975

<u>Region</u>	<u>a</u>	<u>s_a</u>	<u>T_a</u>	<u>b</u>	<u>s_b</u>
Western Siberia	0.634	0.039	16.1	6.240	0.614
Altayskiy Kray	0.605	0.191	3.2	6.660	2.970
Kemerovskaya Oblast	0.149	0.029	5.0	8.220	0.459
Novosibirskaya Oblast	0.770	0.057	13.5	5.470	0.889
Omskaya Oblast	0.779	0.060	12.9	7.700	0.936
Tomskaya Oblast	0.402	0.052	7.7	5.793	0.815
Tyumenskaya Oblast	4.063	0.551	7.4	-24.200	13.571
Eastern Siberia	0.704	0.021	33.4	8.300	0.330
Krasnoyarskiy Kray	0.817	0.041	20.1	8.710	0.630
Irkutskaya Oblast	0.624	0.032	19.3	8.610	0.500
Chitinskaya Oblast	0.540	0.040	13.5	2.780	0.620
Tuvin'skaya ASSR	0.496	0.099	5.0	9.670	1.530
Buryat'skaya ASSR	0.639	0.086	7.4	9.640	1.340

<u>Region</u>	<u>T_b</u>	<u>s_{est}</u>	<u>Ȳ</u>	<u>s_y</u>	<u>R</u>
Western Siberia	10.2	2.98	199.2	76.1	0.990
Altayskiy Kray	2.2	14.40	199.4	77.0	0.970
Kemerovskaya Oblast	17.9	2.23	172.4	49.9	0.990
Novosibirskaya Oblast	6.2	4.32	206.1	82.5	0.970
Omskaya Oblast	8.2	4.54	222.3	93.6	0.990
Tomskaya Oblast	7.1	3.96	180.8	57.0	0.970
Tyumenskaya Oblast	-1.8	41.66	271.6	195.7	0.950
Eastern Siberia	25.3	1.60	219.3	90.9	0.999
Krasnoyarskiy Kray	13.8	3.07	232.0	101.1	0.999
Irkutskaya Oblast	17.1	2.44	215.0	86.4	0.999
Chitinskaya Oblast	4.5	3.02	167.8	52.9	0.999
Tuvin'skaya ASSR	6.3	7.46	218.0	82.4	0.996
Buryat'skaya ASSR	7.2	6.52	216.8	92.5	0.998

All the values of the coefficients of the trend equations considered (with the exception of the trend for the industry of Tyumenskaya Oblast) are significant with less than 5-percent probability of error and can therefore be used for economic analysis. The closeness of the actual values for gross industrial output to the calculated value and to the theoretical trend line is quite evident from Table 2. Since the principal properties and differences of the functions are determined by the laws of variation of their increments, which are discovered by differentiating the functions with respect to time, the first step in analysis is to examine their first and second derivatives.⁵

Calculation of the rates of annual growth of the volume of production on the basis of trends reflects the general tendency of development to a greater

degree. The rate of annual growth, calculated on the basis of the parabolic trend, is monotonic increasing at the beginning of the period and monotonic decreasing thereafter. But the trends differ with respect to the character of variation of the growth rates. The distinctive feature of the trends in industrial development of the two economic regions of Siberia with respect to the character of variation of the rates of annual growth becomes especially vivid when represented graphically (Figure 2). The industrial sector of Eastern Siberia typically has a sharper decrease of the rates of annual growth, the final rate of annual growth at the end of the period is in this case lower (8.0 percent) than at the beginning of the period (8.8 percent), while in Western Siberia the rate of annual growth calculated from the trend is higher at the end of this period (7.8 percent) than at the beginning (6.7 percent).

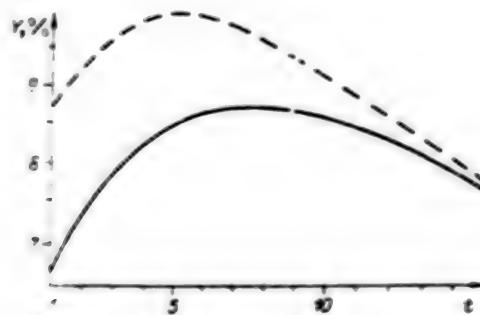


Figure 2. Rates of annual growth of industrial output of Western and Eastern Siberia in the 1961-1975 period, calculated from the trends. Notation the same as in Figure 1.

There is a notable difference among the individual oblasts of Siberia with respect to the rate of growth of the volume of industrial output. The rates of annual growth of industrial output are decreasing to the greatest degree in oblasts belonging to the East Siberian Economic Region (with the exception of Chitinskaya Oblast, where the rates of annual growth were higher at the end of the period than at the beginning) and in Kemerovskaya Oblast of the West Siberian Economic Region.

The dynamic pattern of the industrial production of Tyumenskaya Oblast has notable peculiarities. The equation of the trend which approximates the growth of the gross output of industrial production in this oblast has a negative second member and the largest value of the coefficient a .

The negative sign before the coefficient b reflects the unevenness of development and a change of tendencies in development of industrial production in Tyumenskaya Oblast in the 1961-1975 period, which follows to some degree the actual annual growth rates (Figure 3a). But if we break this period down into subperiods and plot the trends with respect to them, we obtain a more accurate representation of the dynamic pattern of the industrial development, and the statistical reliability of the trend equations is improved. Trend

analysis makes it possible to discover three subperiods in the dynamic behavior of gross output, which differ noticeably in their growth rates: in the 1961-1965 period (Figure 3b) the industrial sector is characterized by low rates of annual growth, but this growth rate is higher in 1965 than in 1961, though only slightly. Over the period 1967-1973 (Figure 3c) the rates of annual growth are almost twice as high as in the previous period. The two last years of the Ninth Five-Year Plan should be regarded separately for purposes of discovering the tendency in the industrial development of Tyumenskaya Oblast in the eighth and ninth 5-year plans, since it is precisely in these years that we observe a sharp rise in the rates of annual growth (25.9 and 41.0 percent). These changes in the dynamics of industrial production of Tyumenskaya Oblast are related to the emphasis put on developing petroleum and gas resources there.

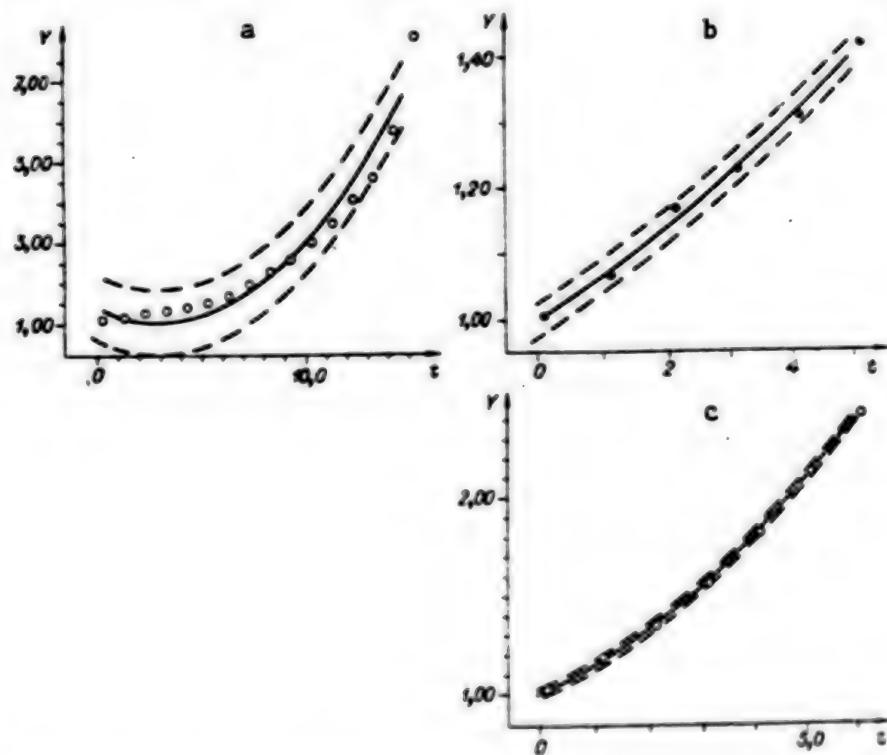


Figure 3. Dynamic pattern of the volume of industrial production of Tyumenskaya Oblast in the 1960-1975 period (a), the 1960-1965 period (b), and the 1967-1973 period (c). \circ , \bullet Actual dynamics of the volume of production; — dynamic behavior of the volume of production calculated from the trend; --- confidence interval; a) $t = 0, \dots, 15$, $t_0 = 1960$; b) $t = 0, \dots, 5$, $t_0 = 1960$; c) $t = 0, \dots, 6$, $t_0 = 1967$.

Appreciable changes took place in the regional distribution of industrial output between the economic regions of Siberia because the volume of gross industrial output grew faster in some oblasts than in others. In 1960

Kemerovskaya Oblast accounted for more than one-third of the industrial production of Western Siberia, Novosibirskaya Oblast approximately one-fifth, while Tomskaya and Tyumenskaya oblasts together produced slightly more than 10 percent of the gross output of the region's industrial sector. By the end of the Seventh Five-Year Plan the situation was changing very slightly: the share of Altayskiy Kray had risen approximately 4 points, and the share of all the other oblasts in the industrial production of Western Siberia had decreased somewhat. Altayskiy Kray's relative share was increasing in the food industry and especially in the region's chemical industry. It is in the Seventh Five-Year Plan that the capacities of the Barnaul Industrial Asbestos Products Plant and the Barnaul Tire Plant went into production.

Later, in the eighth and ninth 5-year plans, there was a slight decrease in Altayskiy Kray's relative share in the industrial output of the region, and as a result the kray's share in Western Siberia's gross industrial output was by 1975 only 2 points higher than in 1960.

Development of the petroleum and gas deposits of Tyumenskaya Oblast brought about a rise in oblast's relative share in the gross output of the region's fuel industry even during the Eighth Five-Year Plan. In 1975 Tyumenskaya Oblast accounted for more than one-third of this region's gross output. There was a corresponding increase in the relative share of that industry in industrial production as a whole (more than doubling between 1960 and 1975).

Omskaya Oblast's share in the gross industrial output of the economic region increased approximately 2 points over this period. This is related to expansion of production in the oblast's chemical, petrochemical and light industries.

As we have already noted, the smallest growth in the volume of industrial output was in Kemerovskaya (2.6-fold) and Tomskaya (2.8-fold) oblasts, which resulted in a reduction of the relative share of these oblasts in the gross industrial output of the region.

In 1960 80 percent of the industrial output of the East Siberian Economic Region was produced in Krasnoyarskiy Kray and Irkutskaya Oblast. In the seventh and eighth 5-year plans they underwent an enlargement of production capacities in the electric power industry, ferrous and nonferrous metallurgy, the chemical and petrochemical industries, and the timber industry. It was in this period that new capacities were put on line at the Bratskaya, Mamakanskaya and Krasnoyarskaya GES's, and that capacities were put into production at the Irkutsk and Krasnoyarsk aluminum plants, the Krasnoyarsk Synthetic Rubber Plant, the Bratsk Timber Industry Complex, and so on.

The preeminent growth of industrial production in Krasnoyarskiy Kray brought about an increase in its relative share in the region's industrial output. Nearly half of the entire industrial output of Eastern Siberia is produced in Krasnoyarskiy Kray.

Irkutskaya Oblast increased its relative share in the industrial production of the region very slightly, and the other territorial administrative units had a smaller share of the volume of industrial production of Eastern Siberia than in 1960. The rise in the annual growth rates in the industrial sector of Chitinskaya Oblast during the Ninth Five-Year Plan, which we previously noted, brought about an absolute growth in the volume of production which was negligible compared to the industry of Krasnoyarskiy Kray and did not even manage to preserve the oblast's previous share in the region's industrial production.

The strengthened role of Tyumenskaya Oblast and of Krasnoyarskiy Kray in the industrial production of Siberia is the result of a concentration of investment activity in these regions. Tyumenskaya Oblast's share in capital investments in the economy of Western Siberia increased from 23.1 percent in the Eighth Five-Year Plan to 33.3 percent in the Ninth Five-Year Plan. Krasnoyarskiy Kray's share in the Ninth Five-Year Plan was almost half of capital investments in the industrial sector of Eastern Siberia. The capital investments envisaged in the plan for the 10th Five-Year Plan provide for an increased role of Tyumenskaya Oblast and Krasnoyarskiy Kray in Siberia's industrial growth.⁶

FOOTNOTES

1. Orlov, B. P., "Aspects of Retrospective Analysis of Siberia's Economic Development," IZV. SIB. OTD. AN SSSR, No 11, 1977, SER. OБSHCHESTV. NAUK, Issue 3, p 88.
2. The calculations of average annual growth rates and trends were made from the data of the reference works: "Narodnoye khozyaystvo RSFSR v 1960 g." [RSFSR Economy in 1960], Moscow, Gosstatizdat, 1961; "Narodnoye khozyaystvo RSFSR v 1965 g." [RSFSR Economy in 1965], Moscow, Statistika, 1966; "Narodnoye khozyaystvo RSFSR v 1975 g." [RSFSR Economy in 1975], Moscow, Statistika, 1976.
3. Procedures for discovering development tendencies and the advantages and shortcomings of various procedures have been set forth in detail in the following places: Anchishkin, A. I., "Prognozirovaniye rosta sotsialisticheskoy ekonomiki" [Forecasting the Growth of the Socialist Economy], Moscow, Ekonomika, 1973; Lizer, S., "Ekonometricheskiye metody i zadachi" [Econometric Methods and Problems], Moscow, Statistika, 1971; Chetyrkin, Ye. M., "Statisticheskiye metody prognozirovaniya" [Statistical Methods of Forecasting], Moscow, Statistika, 1977.
4. The calculations were done according to a program of T. P. Ul'yanova entitled "Collection of Tendencies and Forecasts," worked out in the Institute for the Economics and Organization of Industrial Production of the Siberian Department of the USSR Academy of Sciences. See: "Statisticheskiye algoritmy i programmy" [Statistical Algorithms and Programs], edited by F. M. Borodkin and M. L. Lukatskaya, Novosibirsk,

1970, p 220. The program makes it possible to select the best of 15 functions. The basic quantitative criterion in selecting the proper type of function of the trend was the minimum residual dispersion and the ratio of the residual dispersion to the original dispersion.

5. For a quadratic polynomial the absolute growth (rate of change of the function) is determined by the derivative: $y' = b + 2at$, and the change of the increments (acceleration) by the second derivative: $y'' = 2a$.
6. Orlov, B. P., Op. cit., p 87.

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REDUCTION OF PRODUCTION COST IN INDUSTRY

Moscow FINANSY SSSR in Russian No 8, Aug 79 pp 12-18

Article by Candidate of Economic Sciences V. G. Yankin, chief of a sector of the Scientific Research Institute of Finance, and R. S. Lukina, senior economist of the Scientific Research Institute of Finance: "Reserves of the Reduction of the Production Cost of Industrial Products"

Text The decrease of the production cost is the most important condition for the increase of the profit--the main source of budget revenues, the financing of centralized capital investments and the formation of the internal capital of the enterprise. The development of our economy is characterized by the steady increase of production efficiency, the decrease of production expenditures and the growth of the profitability and the profit. From 1965 to 1979 the profit in the national economy will increase 3.3-fold and will equal 122.3 billion rubles, while the production cost of industrial products will decrease approximately 10 percent.

At the same time during the Ninth and 10th Five-Year Plans the increase of the profit in the national economy slowed. This occurred in all sectors, but especially in industry, the share of which in the total profit is 60-64 percent. The comparison of the average annual growth rates of the profit in comparable and current prices during the above-mentioned period attests that the slow decrease of the production cost was the main cause of the slowing of these rates. According to our calculations, during the 10th Five-Year Plan about 90 percent of the shortfall in the profit will be due to this factor and only 10-15 percent will be connected with the change in prices.

The production cost is one of the indicators of the intensification of production. It is closely connected with the profit and serves as the most important source of the increase of financial resources. The effectiveness of all the work of the socialist enterprise on the increase of production efficiency, the more complete utilization of resources and the acceleration of scientific and technical progress is revealed in the reduction of the expenditures per unit of production. Whereas during the Seventh and Eighth Five-Year Plans the production cost decreased on the average in a year

by 0.9-1 percent, while the share of the profit on the basis of this factor reached nearly 50 percent, during the Ninth Five-Year Plan the production cost decreased annually by 0.6 percent. During the past two five-year plans a definite tendency for the expenditures per ruble of production to decrease slowly and the proportion of the saving from the reduction of the production cost in the increase of the profit to decline appeared. Taking into account the situation which formed in 1976-1978 and the plan for reducing the production cost for 1979, it can be assumed that its average annual rate will slow to 0.3-0.4 percent, and the proportion of the saving from the reduction of the production cost for 1971-1979 will not exceed 30-35 percent.

This tendency is especially noticeable in the sectors of heavy and the extractive industries, light and the food industry. In 1966-1970 the expenditures per ruble of commodity production in heavy and the extractive industries decreased on the average per year by 1.6 percent, in light and the food industries by 0.7 percent; in 1971-1975 correspondingly by 0.3 and 0.1 percent. In 1977 these expenditures of the enterprises of the fuel industry increased by 1.3 percent, ferrous metallurgy--1 percent, the timber industry--1.6 percent, the textile industry--0.3 percent and the fish industry--3 percent. Thus, the rates of the decline of the production cost are slowing primarily in the sectors of the extractive industry and the sectors processing agricultural raw materials, that is, in those sectors which depend on natural, climatic, mining and geological conditions. With allowance for what has been said it can evidently be assumed that the slowing of the rate of decrease of the production cost in the extractive sectors of industry is a natural process. However, this should not influence the increase of production expenditures for industry as a whole. The objective factors which cause the increase of the production cost in the extractive sectors should be made up for by the finding of additional reserves for reducing the consumption of raw materials and materials in the processing sectors, especially machine building. Its development has a decisive influence on the growth of labor productivity, the decrease of the materials-output ratio and the increase of the output-capital ratio in all sectors of the national economy, that is, on the indicators which govern the decrease of expenditures per ruble of production. However, the rate of reduction of the production cost during the Eighth, Ninth and 10th Five-Year Plans in machine building did not increase, but had a tendency to slow down.

The decrease of the materials-output ratio is an important condition for reducing production expenditures. It should be noted that on the whole it has not adversely affected the production cost. During the Ninth Five-Year Plan the materials-output ratio decreased each year on the average by 0.7 percent, in five years an economy of about 9 billion rubles was obtained. In 1976 and 1977 it decreased, according to our calculations, by 1.6 percent, but the economy from this nevertheless did not cover the losses from the underutilization of manpower resources and fixed capital. Thus, the materials-output ratio, without slowing the decrease of the production cost, serves as a significant reserve for reducing production expenditures.

The materials-output ratio is a multifactor indicator. It is significantly influenced by natural factors: the quality of raw materials, the productivity of deposits, the structure of extraction and processing and others. However, their role should not be overestimated. Many things check the decrease of the materials-output ratio: the failure to observe the standards of the consumption of material resources and the nonfulfillment of the assignments on their reduction, the incomplete extraction of natural raw materials from mineral resources and their incomplete processing.

At a number of enterprises the production wastes, losses from defective production and other nonproductive expenditures are great. They arise as a result of the imperfection of the processing method being used and the irrational use of material resources. In 1977 these losses reached 1.7 percent of the total commodity production, and during 1971-1977 the proportion of the losses in the volume of commodity production was approximately the same. However, their absolute values are high and during those years increased 1.5-fold. Production wastes, which are highest of all in light and the food industries, constitute the bulk of the losses. It should be noted that the proportion of the wastes in the value of the consumed raw materials is the highest in machine building. In the ministries of the automotive industry, tractor and agricultural machine building, chemical and petroleum machine building, the machine tool and tool making industry, in spite of the tendency to decrease, the proportion of the waste in the value of the raw materials as before is very high. In 1977 it was equal to 11-15 percent.

Thus, in connection with the growth of the production volume and the absolute increase of the wastes the problem of the stricter control over their commitment to production and their more complete utilization is assuming particular urgency for all the sectors of the national economy, both those which produce raw materials and those which consume them. The lack of capacities for the processing of secondary raw materials is hindering in many respects the solution of this problem. It is necessary for the ministries and departments to begin the elaboration of specific measures on the reduction of production wastes. Evidently, it is advisable to reflect in the calculations of the plan the saving from the reduction of wastes and to take this indicator into account, regularly monitoring its fulfillment.

A great reserve for reducing material expenditures is the reduction of the losses from defective production and nonproductive expenditures. The proportion of these losses in the production cost since 1966 has decreased appreciably, but in recent years, beginning in 1975, it has practically stabilized. This is traced especially clearly in the sectors of heavy industry. It must be noted that in machine building a perceptible decrease of the proportion of defective production in the total amount of production expenditures is not being observed. However, the existing practice of planning the production cost does not direct the attention of the collectives of enterprises to the elaboration of practicable measures on the reduction of defective production and nonproductive expenditures. Now in the

calculations of the plan enterprises and economic organizations are being faced with the practically unfeasible problem of completely eliminating them, while it would be more correct to speak only about reducing them to the level achieved by the leading allied enterprise. Moreover, when planning from the base all the losses from defective production and nonproductive expenditures are already taken into account in the production cost of the past year, which leads to the overestimate of its level during the planning period. It seems most proper to us, when planning the production cost, to set a standard of the reduction of losses. The appropriate amount of the saving should be reflected in the financial plan of the enterprise. A part of it, apparently, should be allocated for paying bonuses to the workers on whom the reduction of losses and nonproductive expenditures depends.

An important way of reducing the losses is the further improvement of the system of standardization and accounting of the consumption of physical assets. So far there is no standard of the consumption of purchased semimanufactures, which constitute in machine building about one-half of the material expenditures. There is no statistical reporting on their use. A standard method of accounting of raw materials and materials is being slowly introduced, today only about 40 percent of the industrial enterprises use it. The standards of the expenditures of raw materials and materials, which are established, as a rule, on the basis of the formed expenditures during the past year, often considerably exceed the actual expenditures, without stimulating the work of enterprises on their maximum reduction.

The existing system of planning and economic stimulation for the production results does not direct the collectives of enterprises toward the use of progressive rates of consumption of raw materials and materials and does not make it incumbent to revise them in due time, as technical innovations are introduced and the organization of production is improved. It is expedient to pay bonuses to the workers of enterprises strictly subject to the saving from the reduction of the production cost, which is obtained as a result of the introduction of progressive rates of consumption of material resources. In the plan of the reduction of production expenditures this saving must be singled out, by reflecting it both in the technical, industrial and financial plan and in the accounting and statistical report.

For many years now in the plan of economic and social development an assignment on the saving of raw materials, materials, fuel and power has been set, for the fulfillment of which bonuses are paid to the workers of enterprises. However, this assignment covers only 40 types of resources, that is, 15-20 percent of all the material expenditures. Apparently, the assignment on the economy of material resources should become the most important component of the plan of economic and social development on the reduction of the production cost, which is closely linked with the norm setting of raw materials and materials, and should cover a large description of resources. It is also necessary, in our opinion, to introduce a special system of fines for the nonfulfillment of this assignment.

A significant reserve for the reduction of production expenditures is the improvement of the use of fixed capital, which is revealed above all in the increase of the output-capital ratio. Its influence on the change of the production cost is reflected in the relative decrease or increase of the amortization deductions per ruble of production, and with an absolute growth of the production volume this influence increases. The decrease of the output-capital ratio in 1971-1975 by 7 kopecks increased the production cost by 2 billion rubles. Whereas during the Ninth Five-Year Plan each percent of decrease of the output-capital ratio increased the production cost by 400 million rubles, during the 10th Five-Year Plan it increased the production cost by 700 million rubles.

The change of the output-capital ratio depends on many factors, which often are not connected with the improvement of the work of the enterprise. They include prices, the structure and value of the fixed capital, the products list and mix, the structure of the sectors and subsectors. The main thing that determines its increase is the level of the organization of labor and production and the observance of planning discipline. Thus, the questions of controlling the indicator of the output-capital ratio are becoming more and more important. First of all it is necessary to increase the influence of the plan and financial and economic levers on this indicator.

The synthetic method of planning with the involvement of a larger group of factors, which characterize the completeness of the use of production equipment, the rate of its replacement and the effectiveness of the replacement of obsolete machines with more advanced ones, should be used more extensively. This will make it possible to take more completely into account in the plan the reserves for increasing the output-capital ratio and to elaborate a set of practicable measures on the better use of the fixed capital.

As to financial influence on the output-capital ratio, it seems to us that the amounts of the fee for capital should depend strictly not only on its value, but also on the degree of use. When determining the rates of this payment it is necessary to take into account the influence of the composition, structure and age of the fixed capital on the results of the activity of enterprises. The differentiation of the standards of the fee for capital according to these features will stimulate enterprises to replace it and use it rationally.

In spite of the fact that the fee for capital increases with the increase of the total profit, in the end the share of it left to the disposal of the enterprise increases in proportion to the increase of the entire profit. A higher standard of the fee for capital should be set for those enterprises which during the period under review did not achieve the better utilization of the equipment, a higher shift coefficient and load coefficient of the equipment. Not the net surplus of the profit, but the internal capital of the enterprise, which is allocated to the economic stimulation funds, should serve as the source of this payment. Let the additional payment not only be placed at the disposal of the ministry, as is the practice in the

Ministry of Tractor and Agricultural Machine Building, but also be allocated in part to the budget. This will force the enterprises to take steps to increase production efficiency.

The analysis of the production cost in industry during the past two five-year plans shows a complex interweaving of the factors influencing its dynamics. There should be understood by factors of the reduction of the production cost not the items of expenditures, but the processes and phenomena in the production economics of enterprises and associations, which determine the level of the production costs. Today in planning the profit the following grouping of technical and economic factors is used: the increase of the technical level of production, the improvement of the organization of production and labor, the relative decrease of the fixed constant expenditures and amortization deductions, the change of the products list (the structure and mix), the improvement of the use of natural resources, sectorial factors (the start-up of new enterprises and works, a different distribution of production), the change of prices. This classification is the basis for the synthetic method of planning of the decrease of production expenditures and makes it possible to detect a change in the initial conditions of production, which are conducive to an increase or decrease of the expenditures.

The enumerated factors influence the production cost in different directions. The change in the structure of production and the product mix, the deterioration of natural conditions and the start-up of new enterprises and works are increasing it during the 10th Five-Year Plan, according to our estimates, by approximately 3 billion rubles, while the relative increase of the amortization deductions is increasing it by 800 million rubles a year.

The increase of the production volume and the relative decrease of the fixed constant expenditures annually decrease the production expenditures by 3.3 billion rubles.

A special place among the technical and economic factors, which lead to a reduction of expenditures, is assigned in the planning of the production cost to the technical and organizational improvement of production. The more extensive introduction and greater efficiency of new equipment directly influence the materials-output ratio, the labor intensiveness and the capital-output ratio of production and are an important reserve for improving these indicators. During the 10th Five-Year Plan it is planned by means of the enumerated factors to decrease the production cost by more than 20 billion rubles. However, according to our estimates, the actual economy in 1976-1978 is approximately 2 billion rubles less than the economy envisaged in the calculations for the plan. The assignments on the introduction of new equipment are not being fulfilled by some ministries. It is above all a matter of the fact that as before the questions of coordinating the economic stimulation of the collectives of enterprises for the production results and for the fulfillment of the plan of the introduction of scientific and technical innovations have not been completely solved. In

the plan on the reduction of the production cost the enterprises often either do not take into account the results of the implementation of organizational and technical measures or take them into account formally, without linking them with the ultimate indicators. The plans on the profit and the production cost are often fulfilled not owing to the introduction of new equipment but owing to structural, price and other factors. This decreases the responsibility of the collectives for the effectiveness of the organizational and technical measures being implemented in production.

The smaller economy as against the plan from the introduction of new equipment is caused primarily by the decrease of its efficiency. For industry as a whole the economy per ruble of expenditures on new equipment decreased from 42.6 kopecks in 1971 to 36.3 kopecks in 1977. This is especially noticeable at the enterprises of machine building (from 48.1 to 40.1 kopecks), light and the food industries (from 42.6 to 36 kopecks). At enterprises of heavy and the extractive industries the efficiency of the measures on new equipment was lower than for all industry on the average.

The measures on the introduction of an advanced processing method are the most efficient. The expenditures on the improvement of technological processes are recovered 1.6-fold more rapidly than the expenditures on the automation of production. However, during the Ninth and 10th Five-Year Plans the scale of the introduction of an advanced processing method decreased. The proportion of the expenditures on these measures decreased from 45.9 percent in 1970 to 39.2 percent in 1977, which is equal to a relative decrease of the amount of financing in five years by 500 million rubles and a loss of the saving of approximately 200 million rubles. Apparently, a nonconformity of the processing method in effect and the new machinery being used in production still exists. The more extensive introduction of new technological processes is an important reserve for decreasing the production cost.

Changes in the structure of production and the output of new and obsolete types of items have a substantial influence on the production cost. According to our calculation, in machine building during the Ninth Five-Year Plan the level of expenditures per ruble of new products (which have been produced for three years since being placed into production) was approximately 1.5 percent higher than the level on the average for the total commodity production, while the level per ruble of obsolete products (which have been produced for more than 12 years) was 3 percent higher. The production of both new and obsolete products equally increases the production cost each year by approximately 120-130 million rubles, which is 20 percent of its total increase under the influence of structural factors in machine building.

It must be said that the adverse influence of the production of new items on the production cost to a certain extent checks the rate of the updating of products. The proportion of the products put into production three years before in the total production volume decreased from 26 percent in 1971 to 22 percent in 1976. The proportion of old products during that

period increased from 12.5 to 13.5 percent. Machine building enterprises are often forced to produce obsolete products. Often the most productive equipment, especially at small and intermediate consuming enterprises, does not correspond to the obsolete technological processes and the enterprises cannot use it at full capacity. At the same time the prices for new machines are two-three times higher than the prices for similar old machines. And it turns out that their use in production instead of old machines worsens the economic indicators of the consuming enterprise. Owing to these circumstances the clients often insist on the production of obsolete equipment. The impact from the use of new equipment in production is fully revealed only with its complete reequipment. It seems that the plans of the assimilation and series production of new equipment must be coordinated more closely with the plans of expansion, modernization and the replacement of equipment at the consuming enterprises both on the national economic level and on the level of the ministries.

The plan on the reduction of the production cost by the introduction of new equipment in many respects is not being fulfilled because in its designing the estimated economic impact is substantially exaggerated. Due to the lack of proper consideration of the actual economy the developers, in striving for greater remuneration, overstate the impact. Moreover, a number of measures in general remain unimplemented or are being used at a much smaller number of enterprises than was called for when designing the technical innovations.

In spite of the fact that the calculations of the economic efficiency are made according to fluctuating items of expenditures, the results of the introduction of new equipment do not affect the rates of consumption of material and manpower resources. These rates, as a rule, are revised arbitrarily, disregarding the change in the technical and organizational level of production. The cases when new rates for raw materials and materials are set in excess of their actual consumption during the preceding year are not isolated. At many enterprises the plans of organizational and technical measures are not linked with the plans of the profit and the reduction of the production cost. The economy is not entirely included in the assignment on the production cost. Such a situation does not direct the attention of the collectives of enterprises toward the finding of technical decisions which ensure the maximum reduction of the production cost of products.

The violation of planning discipline and the nonfulfillment of the assignments on the decrease of production expenditures by means of the introduction of new equipment are also caused by serious shortcomings in the organization of the economic analysis of the fulfillment of the plan on the production cost. The current methods of planning and analyzing the production cost are not coordinated. Two complementary methods of planning the production cost of the commodity production are used in practice: according to the costing items of the expenditures and the synthetic method, according to technical and economic factors. The more extensive use of the latter is economically justified. It makes it possible to coordinate more closely the sections of the technical, industrial and financial plan and to increase

the soundness of the plan for increasing the production efficiency, from which the main indicators of the reduction of the production cost directly ensue. Moreover, the synthetic method makes it possible to reflect more accurately and more completely in the plan of the production cost the results of organizational and technical improvement and the improvement of production conditions, the change of the list and mix of the products being produced and the increase of their quality.

However, this method of planning does not stem from current reporting and is not coordinated with the method being used of analyzing and evaluating the fulfillment of the plan of the production cost according to costing items. The indicators of statistical and accounting reporting--forms No 1-s (periodical), No 5 and No 6--make it possible to evaluate only a portion of the technical and economic factors of the reduction of the production cost, which poorly characterize the productive achievements of the collectives of enterprises and do not have a decisive influence on the level of the expenditures. These include the change in the prices for finished products and material resources, in the conditions of wages and the rates of amortization (deductions, which are recovered from the fund for the assimilation of new equipment, in the expenditures on the placement of new items into production and in the mix of products being produced; the improvement of product quality, the reduction of losses from defective production and nonproductive expenditures. There are no other accounting and statistical indicators which would make it possible to study in more detail the causes of the nonfulfillment of the plan on the reduction of production expenditures. Moreover, such indicators are also absent in the intraplant reporting of enterprises. As confirmation let us cite a table.

Composition of the factors taken into account in the calculations of the plan on the reduction of the production cost	Composition of the indicators which are used (or are suitable) for analyzing the fulfillment of the plan on the reduction of the production cost and which are contained in	
accounting reporting	statistical reporting	
Production cost and expenditures per ruble of commodity production	Expenditures on production by items (form No 5). Production cost and expenditures per ruble of commodity production (form No 6)	--
Increase of technical level of production	Economy from implementing measures on new equipment by means of bank loans (form No 2)	Economy as a result of the introduction in production of new equipment and rationalization proposals (form No 10-nt and form No 4-nt)

Composition of the factors taken into account in the calculations of the plan on the reduction of the production cost	Composition of the indicators which are used (or are suitable) for analyzing the fulfillment of the plan on the reduction of the production cost and which are contained in	
accounting reporting	statistical reporting	
Improvement of the organization of production and labor	Economy from the reduction of administrative and management costs (form No 14). Losses from defective production (form No 6). Non-productive expenditures (form No 7 and form No 9)	Economy from the reduction of the production cost as a result of the implementation of measures on the scientific organization of labor (form No 19-t/NOT)
Relative decrease of fixed constant expenditures	--	--
Relative decrease of amortization deductions	Amortization of fixed capital (form No 5)	--
Change in the structure (list and mix) of products (according to variable expenditures)	Expenditures per ruble of commodity production according the plan which has been converted to the actual output and mix (form No 6)	--
Increase of product quality	Economy from the increase of the quality and grade of products (form No 6)	--
Sectorial factors (start-up of new shops and facilities, change of location of production and others)	--	--

Composition of the factors taken into account in the calculations of the plan on the reduction of the production cost	Composition of the indicators which are used (or are suitable) for analyzing the fulfillment of the plan on the reduction of the production cost and which are contained in	
	accounting reporting	statistical reporting
Change of prices, the wage conditions, the rates of amortization and the valuation of fixed capital	Change of the production cost as a result of the increase of the planned wage fund, the one-time revision of the rates of amortization and the revaluation of the fixed capital, the change in the prices for raw materials, materials and fuel, which was made in accordance with established procedure (form No 6).	--

Due to the lack of reliable reporting such important factors as "the increase of the technical level of production" and "the improvement of the organization of labor" do not yield to qualitative analysis. The method of taking into account the economic efficiency of new equipment and the scientific organization of labor, which is now used in practice, requires further improvement. The actual economy from the implementation of measures on new equipment and the scientific organization of labor, which is reflected in statistical reporting forms Nos 10-nt and 19-t(NOT), is not sufficiently reliable and is of an estimated nature. This is caused above all by the fact that when calculating this economy the completeness of the use of the technical innovations introduced in production is not taken into account. The economy is often calculated by using the same estimated indicators which were used to determine the efficiency of new equipment at the stage of its introduction in production or even designing.

In order to increase the reliability of the information on the efficiency of new equipment it is necessary to organize the primary accounting of the economy according to variable items of expenditure, which was actually obtained as a result of its introduction.

The bringing of the methods of the planning of the production cost and its analysis into line will require some refinement of current accounting. It must be said that the reflection in accounting reporting of the economy from the introduction of new equipment is already being used in practice. In particular, the amount of the economy in connection with the implementation of measures on new equipment by means of bank loans is reflected in form No 2, "Appendix to the Balance Sheet." It is expedient in this return in

certificate 2 of form No 6 to show the economy from the introduction in production of all the measures on new equipment, regardless of the sources of their financing.

The questions of reducing the production expenditures are most urgent not only for unprofitable enterprises, but also for enterprises planned to operate with a profit, which allow losses. An analysis showed that 40 percent of the total amount of the losses of industry in 1977 occurred at enterprises planned to operate with a profit. Their elimination here is developing into an independent problem. Whereas at subsidized enterprises a procedure of forming incentive funds for the reduction of the unprofitability is in effect, at enterprises planned to operate with a profit the use of the indicator of profitability or the reduction of the production cost as fund-forming indicators does not yield the proper effect, since it does not aim the collectives toward the elaboration of practicable measures on the reduction of the unprofitability of products. The losses from their sale are offset by the production of highly profitable, but at times unmarketable items, and the overall favorable results conceal the shortcomings in the work of the enterprises on reducing the production expenditures on the group of unprofitable items. It seems that an assignment on reducing the production cost must be established without fail for enterprises at which the proportion of unprofitable items in the total output of the commodity production is high (in excess of 10-15 percent). It should be of a purposeful nature according to specific types or groups of items with the segregation of the unprofitable products from the total volume of the commodity production. If the plan on the reduction of the production expenditures for the group of unprofitable items is not fulfilled, it is necessary to deprive the enterprises in full or in part (50-70 percent) of the bonuses credited for the reduction of the production cost for all the commodity production, as is the practice with the nonfulfillment of the obligations on deliveries. Thus, the decrease of the expenditures for unprofitable items will become an important condition for the completeness of the crediting of the economic incentive fund during the year under review. This will force the enterprises to draw up and implement specific measures on eliminating the unprofitability of products.

It is possible to overcome the noted tendency for the increase of the profit and the decrease of the production cost to slow only on the basis of the stricter economy and mobilization of new reserves on the basis of the acceleration of scientific and technical progress.

The reduction of the production cost during the 11th Five-Year Plan by only 3.5 percent, according to our calculations, will require an economy of resources in the amount of 24 billion rubles. This is twice as much as during the Ninth Five-Year Plan and the anticipated amount during the 10th Five-Year Plan. A significant improvement of the financial mechanism is necessary to solve this problem. Above all it is necessary for the entire impact from the implementation of organizational and technical measures to be fully coordinated with the assignment on the increase of the profit and the

reduction of the production cost, with the financial plan and the planned amount of the stimulation funds. This will make it possible to increase the influence of the plan and financial and economic levers on the maximum economy of resources.

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PACKING INDUSTRY CONFERENCE REPORTS

Moscow MATERIAL'NO-TEKHNICHESKOYE SNABZHENIYE in Russian No 7, Jul 79 pp 65-68

[Text] The struggle for quality, saving material resources and protecting output from spoilage or losses in transport and storage is inseparably connected with using packaging efficiently. In connection with the growth in industrial and agricultural production, with the broader assortment of output being produced, and with expansion of export deliveries, the packaging economy has become a most important link in the sphere of production and consumption.

A modern economy needs a variety of specialized packaging. This thought stood out in all the speeches at the All-Union Conference on Problems of Providing the National Economy With Packaging.

Participating in its work were workers of the USSR and union republic gos-snabs, RSPSR rayon material and technical supply administrations, packaging repair enterprises, associations (trusts) and administrations of the USSR Gossnab, ministries and departments.

For two days, there was an open, impartial discussion of the status of packaging. In order to demonstrate the place being given to it in the national economy, suffice it to present the following figures. Last year, expenditures on releasing packaged output exceeded 12 billion rubles; some 73.1 million cubic meters of wood and cardboard shipping packaging (converted to rough logs) was supplied for packaging goods and materials.

The safety of the goods and materials packaged and transported depends on the protection offered by the packing and packaging and on how well it meets the demands of today. Statistics bear out that up to 15 percent of the cement, an expensive building material in short supply, is being lost due to standard packaging. The result is that several large enterprises are operating on wind, in the literal sense of the word. Large amounts of mineral fertilizers are being lost due to unsuitable packaging. In spite of

enormous expenditures, the country's economy is still being provided with both quantitatively and qualitatively inadequate packing and packaging materials.

N. I. Lykov, chief of the Soyuzglavtara, gave a report on "Work Results for 1978 on Supplying the National Economy with Packing and Packaging Materials and Tasks for 1979 in Light of the Resolutions of the November (1978) CPSU Central Committee Plenum and the 10th Session of the USSR Supreme Soviet."

He noted that, in carrying out the resolutions of the 25th CPSU Congress and subsequent CPSU Central Committee Plenums and, being governed by the theses and conclusions laid out in speeches by Comrade L. I. Brezhnev, CPSU Central Committee General Secretary and USSR Supreme Soviet Presidium Chairman, concerning increasing work efficiency and quality, Gossnab organs, jointly with USSR ministries and departments, have done specific work to improve the production and consumption structure of shipping packing and supplying the national economy with it.

In the 10th Five-Year Plan, the structure of raw material being allocated to produce packing is being improved each year through the expanded release of economical types of cardboard, wood-fiber sheet and other progressive types of materials. In the overall balance of resources being distributed, 62 percent of the demand is being met by new packing materials and 38 percent by supplying the consumer with returnable packing.

Plans for producing and delivering new packing are approved by the ministries and departments with the concurrence of the Soyuzglavtara and USSR Gossnab; the collection, repair, reprocessing and delivery of returnable packing are planned and implemented by the Soyuzglavtara.

Forty-eight ministries and departments produce packing. Wood packing is manufactured by more than 6,000 enterprises, cardboard by 132 and metal by 127. In this regard, 60 percent of the wood packing is supplied as parts (disassembled wooden crates and staves) and 40 percent, due to a shortage of facilities at timber and woodworking industry enterprises, as rough lumber, sawn lumber, plywood and presswood.

USSR Gossnab organs have done a great deal of work to save material resources. As a result of the introduction of more progressive packing material expenditure norms, a pansion of the volume of shipments in containers and packets, the use of reuseable packing, and the search for other additional resources, 5.7 million cubic meters of commercial wood has been saved and the national economy has been supplied with 583,000 steel barrels and 4.8 million cubic meters of commercial corrugated cardboard scrap above the plan, which has permitted a savings of 30,000 tons of sheet steel and 50,000 cubic meters of commercial wood.

The use of reuseable packing, one cubic meter of which an average of 9.3 cubic meters of lumber, plays an important role in saving resources. Last year, 249,000 cubic meters of crate units for reuseable packing was

manufactured and supplied to consumers, providing a savings of more than 2.3 million cubic meters of commercial wood.

Competition to save resources has been developed widely in gosnabs of the Ukraine and Lithuania and in the administrations of material-technical supply of Moscow, Volgo-Vyatskiy, Zapadno-Sibirskiy, Priokskiy and Severo-Kavkazskiy rayons. Sad to say, the initiatives of the leading collectives have not encountered the proper support in the gosnabs of Kazakhstan, Kirgizia and Tadzhikistan or the administrations of material-technical supply of Bashkirskiy, Yuzhno-Ural'skiy, Vostochno-Sibirskiy, Krasnoyarskiy and a number of other RSFSR rayons. There are serious claims against the USSR Ministry of Timber and Wood Processing, Ministry of Chemical Industry and State Committee for Forestry, whose enterprises consistently fail to meet plan assignments and are hardly increasing their capacities at all.

Interesting experience has been accumulated in Belorussia in the thrifty use of material resources through the repeated use of packing, introduction of progressive packing expenditure norms, an increase in the volume of unpackaged shipments in containers and packets, and the use of reuseable packing. L. I. Tonkiy, chief of the Beltara Trust, shared it with us in his speech.

When funds are allocated, questions of reducing the consumption of materials through improved packaging design are discussed with each ministry, department or enterprise. The organization of reuseable packing assembly and maintenance in the republic merits attention.

Each packing maintenance enterprise is assigned a collection zone for return packing. According to Central Statistical Administration data, lists of facilities returning packing and located in these zones are drawn up: enterprises, construction sites, stores. An amount of packing subject to reuse is determined for each packing returner on the basis of primary accounting documents. Substantiated plans for releasing the packing being freed for other use by each packing returner, packing repair enterprise and the republic as a whole are established on the basis of this information. As a result, the collection, repair and reuse of returned cardboard packing increased 2.1-fold last year, and of wood packing -- 1.5-fold. Some 700,000 cubic meters of rough-timber equivalent is now being saved each year because of this.

Of decisive importance in saving packing and packing materials and in improving supplies to the national economy is the development and introduction of progressive packing expenditure norms for packaging output. On assignment from the USSR Gosnab and Soyuzglavtara, the VNIEKITU, jointly with branch scientific research institutes, has developed and introduced progressive packing expenditure norms. In 1978, an additional 1.8 million cubic meters of rough-timber equivalent wood was obtained from this, and this year we anticipate saving another 200,000 cubic meters. The use of progressive norms for packaging canned goods alone, for example, enabled us to reduce packing expenditures by 700 cubic meters. However, work along these lines is still

not an everyday concern in the activity of territorial organs, trusts and associations, producers and consumers of packing.

Unfortunately, during the three years since the USSR Gossnab collegium decided to create special subdivisions to organize such work, the demand for packing in many rayons has been determined without proper analysis of its actual expenditures. The calculations often recognize the consumer's desire to have available to him as much material resources as possible. When reviewing 1979 demands, Soyuzglavtara specialists revealed and rejected as unsubstantiated applications for 6.2 million cubic meters of lumber, or eight percent of the total demand.

Packet and container shipments are a most important direction in saving packing, as are the mechanization and automation of loading-unloading and warehousing-transport operations. For example, enterprises of the Ministry of Building Materials has more than 126,000 special containers, in which 45 percent of the window glass was shipped in 1978, permitting a savings of 500,000 cubic meters of wood. Losses of fruit and vegetables are significantly reduced when they are shipped in special pallets developed by the VNIEKITU. Such losses are reduced two-fold just for watermelon and other melon shipments, and an economic impact of seven rubles per ton is achieved as compared with the traditional method.

Providing agricultural output with packing, and fruits and vegetables in particular, has always been one of the most important tasks of material and technical supply organs.

As Azerbaijan SSR Gossnab Chairman R. A. Guseynov emphasized in his speech, a commission of the USSR Gossnab's Main State Inspectorate operated in Azerbaijan in 1977, revealing a number of violations in the use of fruit and vegetable packing. On the initiative of the USSR Gossnab, the results of the commission's work were discussed in the republic Council of Ministers. Additional funds were allocated and suppliers determined, thanks to which Azerbaijan's packing requirements for shipping out fruit and vegetables were met in full last year.

The year 1978 was marked by achievements from the viewpoint of further strengthening the material base of packing maintenance enterprises. Some 17 enterprises and shops with a total capacity of 36.1 million packing units per year were put into operation.

The work done in this direction by the Mosgortara administration merits attention.

This administration, its chief, A. V. Turkhin, reported, succeeded in supplying on an industrial basis the primitive, scattered packing enterprises obtained from trade. The administration warehouse system was simultaneously put in proper order. When warehousing organizations were paid insufficient attention, there was always a shortage of space. Now there is no shortage.

A radial collection of return packing from trade and public catering enterprises has been organized. The problem of reprocessing packing scrap not suitable for reuse into crude wood chips has been solved. An automatic reprocessing line with a capacity of 20,000 cubic meters has been installed. This has enabled us to reduce motor transport expenditures (hauling to the dump) and to involve additional resources in the manufacture of presswood and chipboard.

At the same time, meeting participants noted that in 1978 there were substantial shortcomings in the work of the union republic gosnabs, the material-technical supply administrations in RSFSR rayons, packing trusts, administrations and associations, and the packing repair enterprises of the ministries and departments.

Individual ministries and departments did not take the steps necessary to carry out the 1978 plans for producing and delivering packing. For that reason, the wooden box unit delivery plan was met by only 88.7 percent, and the pouring barrel clapboard delivery plan -- 79 percent. We failed to supply the national economy with 2.3 million cubic meters of packing (rough-timber equivalent). The plan for delivering steel drums was met by 89 percent, and the plan for oil tanks, carboys and milk cans -- 91 percent.

The deliveries of these types of packing did not improve in January-February 1979 either. The ministries and departments have made insufficient use of deciduous woods to manufacture packing, have not done the necessary work to specialize packing enterprises, and have not developed facilities to produce economical thin-wall packing. They basically produce packing crate planks 10-13 mm thick, instead of 4-6 mm, which leads to considerable wood overexpenditures.

A majority of the enterprises consistently fail to meet plan assignments on producing crate units, while the equipment available at enterprises of the USSR Ministry of Timber and Wood Processing Industry is being used in only one shift. Due to a lack of special equipment, wooden packing not suitable for further use is basically unutilized, that is, burned.

Insufficient use is being made of economical reusable packing when shipping output and packetized and containerized shipments are not being extensively developed. Eleven material and technical supply administrations did not meet the plans established for delivering returnable packing, a shortfall to consumers of 200,000 cubic meters. The 1978 capital investment plan was not met. Only 24.7 million rubles of 30.5 million was utilized, or 81 percent, including only 75 percent of the planned investment in building and installation work.

Having analyzed the present status of packing in the country, the all-union conference set the Soyuzglavtara, union republic gosnabs, RSFSR rayon material and technical supply administrations, and packing trusts, associations and administrations the national-economic tasks of:

ensuring the prompt supplying of consumers with new and returnable packing in accordance with the established plans and assignments, agreements concluded, and job authorizations accepted for execution;

taking steps to further develop deliveries of packing and packing materials on the basis of direct, long-term economic ties;

creating a 50,000 cubic meter returnable packing reserve at packing maintenance enterprises by 1 July 1979 to ensure above-plan procurement of fruit and vegetable produce in accordance with the Soyuzglavtara assignment;

taking steps in 1979 to use packing efficiently and economically in conformity with established assignments through the use of progressive types of packing, to significantly expand the amount of unpackaged output shipped in containers and packets, to increase the reuse of packing, to eliminate packing losses in storage and use, and other steps;

putting 20 packing maintenance enterprises with a total capacity of 44 million packing units into operation in 1979;

accelerating the utilization of new packing-maintenance enterprise capacities;

developing and implementing measures to create model-demonstration packing-maintenance enterprises in each rayon during 1979-1980.

The all-union conference recommended that the USSR Ministry of Timber and Wood Processing Industry, Ministry of Pulp and Paper Industry, USSR State Committee for Forestry, Ministry of Chemical Industry and other ministries manufacturing packing take steps to raise the technical level and anticipate the development of economical types of packing and packing materials for production in the 1980 plan.

It recommends that the Ministry of Pulp and Paper Industry improve the quality of packing cardboard and boxes, accelerate the development of cardboard packing production capacities, especially in rayons of Siberia, the Far East and the Baltic states, to eliminate inefficient shipments, and increase the production of compact glued cardboard boxes to package butter and margarine, as well as the production of water-repellant cardboard.

The conference requested that the USSR Gosplan anticipate the following in annual and long-range plans, beginning in 1980: allocation to ministries and departments of the capital investments necessary to develop facilities to produce containers and packing units; meeting in full the national economy's packing materials requirements, and first of all of economical types such as packing cardboard, glued plywood, solid wood-fiber sheet, polymer synthetic materials and rolled metal; anticipate in the state plan for USSR economic and social development in 1981-1985 the start-up of capacities to produce a maximum of economical types of cardboard and polymer packing.

Conference participants called on all workers employed in the sphere of producing and supplying the national economy with packing to develop more extensively socialist competition for a stable supply of packing and packing materials to the country's economy.

Participating in the work of the conference were A. N. Lebed', Deputy Chairman of the USSR Gossnab, V. Anisimov, an instructor in the planning and financial organs department of the CPSU Central Committee, and G. I. Ul'yanov, Secretary of the Kaluzhskaya Oblast Committee of the CPSU.

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ECONOMICS OF FUEL, RAW MATERIAL, POWER COMPLEX

Moscow FINANSY SSSR in Russian No 8, Aug 79 pp 18-22

Article by V. Ye. Orlov, chief of the Administration for Financing Heavy Industry of the USSR Ministry of Finance: "On Some Questions of the Economics of the Sectors of the Fuel, Raw Material and Power Complex"

Text The development of the Soviet economy has been characterized by the rapid growth rate of industry. Our country produces approximately one-fifth of the world volume of fuel and power resources. From 1917 to 1978 the generation of electric power increased 546-fold, the production of petroleum--65-fold, the production of coal--23-fold, the production of steel--49-fold and the production of cement--127-fold. The production of gas in 1978 reached 372 billion m^3 as against 3.2 billion m^3 in 1940. These figures attest more clearly than any words to the successful fulfillment of the five-year plans of USSR national economic development, the counting off of which began 50 years ago.

The consolidation of the material and technical base presumes the achievement of a higher level of technology and the intensification of the processes of concentration, specialization and cooperation on the basis of the economically sound investment of state assets and their proper allocation to the value of the products being produced.

Today the wholesale prices for the products of a number of sectors of the fuel, raw material and power complex do not reflect the socially necessary expenditures, which owing to certain circumstances are increasing sharply, which adversely affects cost accounting relations.

The increasing demand of the country for raw materials, fuel and power is creating the need for the development of the deposits of Siberia and the Far East. Great changes are occurring in the extraction of fuel by regions of the country. The proportion of the European part is decreasing, while that of the regions located to the east of the Urals is increasing. The ratios in fuel consumption have been changing negligibly.

It should be stated that in recent years geological conditions have grown worse and the amounts of extraction of fuel and raw material resources at deposits developed earlier have decreased. The expenditures on the improvement of product quality and environmental protection have increased. Major measures on the regulation of wages in industry and the improvement of the working conditions of the workers have been implemented. The standards of the amortization deductions for the replacement of fixed production capital have been revised. The rise in world prices for purchased equipment and components had a definite influence on the increase of expenditures.

In many fuel and raw material sectors the ratio of capital investments, the capital-output ratio of products and their production cost have increased. The profitability of production has decreased. The increase of the ratio of capital investments per ruble of increase of the production of the commodity (gross) production for industry as a whole according to the plan for 1976-1980 as against 1971-1975 was 115.2 percent, including 108 percent in electric power engineering, 123.3 percent in the oil drilling industry, 139.2 percent in the petroleum refining industry, 113.2 percent in the coal industry, 123.6 percent in ferrous metallurgy, 141.8 percent in nonferrous metallurgy and 153.6 percent in the pulp and paper industry.

In connection with the further advance of the fuel and raw material sectors into the eastern and northern regions the capital-output ratio of production will increase. During the Eighth Five-Year Plan on the average per year the decrease of the expenditures per ruble of commodity production for industry as a whole was 1 percent, while during the Ninth Five-Year Plan it was 0.6 percent. The production cost of the products of a number of sectors increased mainly due to the accelerated development of industry in the poorly developed eastern and northern regions of the country. In connection with the depletion of reserves the conditions for extracting fuel and raw materials at old deposits worsened. As a result the expenditures on the production of 1 ton of petroleum increased according to the plan for 1979 as against 1965 1.5-fold, 1 ton of coal--1.2-fold, on the logging of 1 m³ of lumber--1.7-fold.

Calculations show that the process of the increase in the cost of production and the decrease of the profitability in a number of raw material and extractive sectors will not be completely halted, but it is being checked by the more and more extensive utilization of the achievements of science and technology.

In the formation of prices for fuel and raw material resources it is impossible not to take into account the natural limitation of reserves. The maintenance of the relatively low prices, which were set mainly with allowance for sectorial expenditures, for such types of raw materials and fuel as coal, petroleum, gas, fuel oil and metal does not conform to the national economic importance of these resources and does not stimulate their better processing, complete and economical use and the reduction of waste and losses.

The wholesale prices in effect do not reflect completely the entire complex of national economic expenditures on the production and sale of products. The expenditures on geological prospecting and the renewal of timber resources, the costs for social insurance and others are not reflected in their production cost and no more than half their amount is recovered. The remainder is covered by the redistribution of monetary savings through the state budget. By means of the rates of reimbursement of the expenditures on geological prospecting, which were introduced in 1967, approximately one-fourth of the total expenditures for these purposes were recovered through the production cost. In 1970 the group of minerals, for which the indicated rates are established, was enlarged, and the proportion of the reimbursement for petroleum, gas, nonferrous metal ores and mica was increased. However, for some minerals, and particularly coal, the expenditures on geological prospecting are not included in the production cost. According to the plan for 1980, of the 4.6 billion rubles of total expenditures on geological prospecting (including exploratory drilling) 2.7 billion rubles will not be taken into account in the production cost.

For the purpose of recovering the expenditures on reforestation a fee per stump has been established for all loggers. In connection with the increase of the expenditures on timber management from 538 million rubles in 1968 to 1 billion rubles in 1980 the rates of the fee per stump in effect recover and will recover approximately half of the expenditures on reforestation.

Under the formed conditions it is necessary, in our opinion, in the sectors of the fuel, raw material and power complex to implement measures on the further improvement of wholesale prices in order to enhance their stimulating role in the acceleration of scientific and technical progress, the updating and improvement of the quality of products and the more rational use of material resources. This should ensure the conformity of prices to the socially necessary expenditures on the basis of the consideration of all the trends of economic development during the 10th Five-Year Plan and in the future, should improve their use for the purposes of measuring production efficiency and saving expenditures and should promote the improvement of planning, the expansion of cost accounting relations in industry and the increase of the effectiveness of economic levers and stimuli.

The prices of coal are of fundamental importance for the organization of the entire system of wholesale prices. According to the plan for 1979 the losses from coal mining exceed 1 billion rubles. In 1980 they will increase and will be approximately 1.1 billion rubles (13.1 percent of the production cost of products). The unprofitability is caused by the deterioration of geological mining and operating conditions, the commitment to working of seams with a higher ash content and moisture content, as well as seams which occur at great depths. As preliminary estimates show, during the 11th Five-Year Plan the tendency for the cost of coal mining to increase and the profitability to decrease will be maintained. A slight increase in the mining of less expensive coal in the Ekibastuz and Kansk-Achinsk basins will not have a significant influence: the overall increase of expenditures in the sector will not stop, although it might slow somewhat.

The unprofitability of the coal sector had the result that in the 1979 plan provisions are made for the allocation from the state budget of 2.2 billion rubles for state grants, the formation of economic stimulation funds and planned expenditures (the covering of the losses of housing and municipal services, the increase of the standard of internal working capital and others).

The establishment of economically sound prices for coal with allowance for the prospects of development of the sector and the entire fuel and power complex is important both for the stimulation of the rational use of fuel and for the proper reflection of the fuel component in the production costs and the calculations of the economic efficiency in all the sectors of the national economy.

The production cost of one ton of petroleum continues to increase. The improvement of the methods of establishing the wholesale prices for petroleum is possible only with allowance for the conditions of the development and location of the petroleum industry. The centers of development of the sector have been moved to regions with extremely severe natural and climatic conditions, where the level of expenditures per unit of work is approximately twofold higher than in the old regions. The natural decrease of the production volumes at the old deposits is being accompanied by an increase of the specific expenditures per ton of petroleum. A greater and greater share of the newly created capacities is being consumed for offsetting the decline of production. Whereas during the Eighth Five-Year Plan new capacities in the amount of 2 tons were created in order to obtain a 1-ton absolute increase in petroleum production, in 1977 this amount increased to 3.8 tons. The allocation of a constantly increasing share of the capital investments for offsetting the natural decline of productivity of the deposits being worked is responsible for the increase of the capital-output ratio and the expenditures on petroleum production.

The decrease of the provision of the European part of the country with petroleum reserves, the shift of the largest deposits to the late stage of working and the decrease as a result of this in the production at them, and the use of relatively less productive deposits in remote regions of the country are objective reasons for the increase of the production costs in the oil drilling industry. Under such conditions, with the maintenance of the existing level of wholesale prices, the overwhelming majority of production associations of the sectors in 1980 will already be unprofitable. Taking this into account, as well as on the basis of the need to include in the production costs all the expenditures on geological prospecting and to increase the contributions for social insurance, the wholesale prices for petroleum, in our opinion, should be increased significantly.

When determining the average level of the price for petroleum it is necessary to bear in mind the need to create normal production economic and financial conditions for the oil drilling associations which carry out their activity under complicated and constantly deteriorating geological mining

conditions. At the same time the wholesale price level should be conducive to the saving and economical consumption of the nonrenewable petroleum resources of the country. An increase will create real conditions for the elaboration of a uniform price for the petroleum being delivered to petroleum refining enterprises and uniform prices of enterprises for petroleum products. The existence in the petroleum refining sector of seven group prices for petroleum and the same number of group, as well as individual prices of enterprises for petroleum products does not promote the proper determination of the actual results of the work of enterprises and creates difficulties in the planning of the output of products, since the results in many respects depend on the location of production.

Under the conditions of the increase in the demand of the national economy for the most important petroleum products the use of fuel oil for its refining into motor fuels and raw materials for the petrochemical industry is assuming great importance. In connection with the limitation of petroleum resources, as well as for the stimulation of the more economical consumption of furnace oil it is necessary to increase the wholesale prices of industry for it.

The increase of wholesale prices for petroleum will require an increase of the prices for petroleum products for ensuring the cost accounting activity of petroleum refineries. It is advisable to accomplish it without an increase (with the exception of fuel oil) of the prices for consumers by means of a reduction of the turnover tax on petroleum products.

The revision of the wholesale prices for coal and fuel oil dictate the need to increase the prices for gas. The low prices for gas are leading to the irrational consumption of this important raw material. In terms of heat equivalent the price of gas is one-seventh the price of electric power for industrial consumers. This ratio is economically unjustified, does not create the conditions for increasing the efficiency of gas use and leads to a higher demand for it.

The established ratio of the prices for coal, gas and fuel oil (100:95:112) does not promote the rational use of gas and fuel oil. When drawing up the new wholesale prices in addition to the heat value there should be taken into account the fact that relatively large reserves of coal as compared with gas and petroleum have been proven in the country. Therefore the wholesale price of coal should be lower.

In spite of the great efficiency of the use of gas in the chemical industry, ferrous and nonferrous metallurgy and other sectors of the national economy, considerable amount of it is being burned at electric power stations and boiler houses. In this connection it is necessary to implement measures on improving the structure of its consumption. The establishment of a higher price for gas as compared with coal should be one of these measures.

The increasing demand of the national economy for light petroleum products, which gives rise to the need to decrease the output of furnace oil and to

establish a higher wholesale price for this type of fuel, should also not be overlooked. With allowance for what has been said the following ratio of the wholesale prices for coal, gas and fuel oil should be established-- 100 : 120 : 130. It is economically justified and will promote the establishment of the most correct proportions in the use of fuel and power resources.

From 1968 to 1977 the profitability of electric power engineering, which is calculated with respect to the productive capital, under the influence of a large number of factors decreased from 10.6 to 6.2 percent. This trend as a whole will be maintained. The increase of the rates for thermal energy and electric power (without their increase for agriculture, the population and housing and municipal services) should depend on the level of the increase of the wholesale prices for coal, gas and fuel oil and is obliged to take into account such factors as the increase of the proportion of the more capital-intensive types of electric power stations, particularly AES's, the increase of the cost of generating electric power at thermal electric power stations in connection with the increase of the proportion of coal in the fuel balance, the increase of the capacity of electric power stations and the length of the electric power grids in the northern and northeastern regions of the country, the accelerated development of the electric power grids and the increase of the proportion of the most expensive long-distance high-voltage electric power transmission lines, the implementation of a major program of the electrification of agriculture and the placement of all the costs for operating rural networks on the USSR Ministry of Power and Electrification.

To ensure a normal profitability of enterprises and to differentiate prices for the purpose of establishing an equal profitability of the items being produced, stimulating the production of smaller shapes and dimensions, as well as the saving of metal by consumers it is necessary to increase the wholesale prices for the products of ferrous metallurgy by such amounts that the profitability, which is calculated with respect to the productive capital, would be about 14 percent.

Taking into account the deterioration of the geological mining conditions of the extraction of mineral raw materials for the production of nonferrous metals and the need for their rational consumption in the sector of nonferrous metallurgy as a whole, it is necessary to establish the profitability (as a percentage of the capital) at 13 percent. The prices should stimulate thrift in the use of nonferrous metals and their replacement with less scarce materials.

From 1967 to 1978 the cost of logging steadily increased. Its profitability decreased from 22.6 percent in 1968 to 2.8 percent in 1975. In the past 12 years with a 53.5-percent increase in the expenditures on the felling and hauling of timber wholesale prices rose 12 percent. The increase of the production cost and the decrease of the profitability were caused mainly by the shift of logging to the heart of Siberia and the Far East, the increase

wage rates and salaries, the introduction of regional coefficients for wages and new norms of amortization deductions, as well as a number of other factors. In order to produce 1 m³ of lumber in the eastern regions of the country 1.5-2 times more capital investments are required than in the European part of the country. The increase of the distance of timber hauling also has some influence. For timber managements this distance is on the average 43 km. In some cases a shipment of 300 km is made, which leads to a great fluctuation of the expenditures which fall to 1 m³ of timber. There should also be taken into account the fact that the increase of the cost of new logging equipment is not always recovered by means of the increase in its productivity. Thus, with the more than twofold increase of the price of the P-2 jaw loader its rated power increased only 30 percent.

Since the tendency for the cost of logging to increase as a result of the effect of the enumerated factors will be maintained, the wholesale prices of enterprises and industry for round timber should be increased. It is necessary to establish them with allowance for the orientation of the national economy toward the economical use of timber, its more complete processing and the extensive introduction of substitutes. The wholesale prices for the products of sawmill operation, the wood working, pulp and paper industries will have to be increased.

The revision of the wholesale prices in the fuel and raw material sectors should be carried out in order:

to bring the prices closer to the socially necessary expenditures, to enhance their role in the measurement of economic efficiency, the selection of economical versions of the development of production and the assurance of the balance of physical and monetary proportions, the efficient use of resources and the more correct consideration of the consequences of the economic decisions being made;

to create the necessary conditions for the improvement of the entire system of planning, economic stimulation and management, to introduce cost accounting methods more extensively in the sectorial management of production; to ensure the relative stability and invariability of wholesale prices and on this basis to tighten up state planning and financial discipline in the economy;

to achieve a more correct ratio of the prices for individual types of fuel and power resources (coal, gas, fuel oil), as well as for the products of ferrous metallurgy;

to create for heavy industry enterprises in a number of regions of the country (above all the coal and metallurgical industries in the Ukraine) conditions of economic activity, which would be conducive to the improvement of the results of their operation;

to ensure the convergence of the practice of pricing in the CEMA member countries, the structure and level of prices, in order to promote the more

accurate selection of the versions of the specialization and cooperation of production and the proper determination of reciprocity in foreign trade and foreign economic relations.

The change in wholesale prices, as estimates show, can be accomplished without losses to the state budget.

In our opinion, in order to enhance the role of wholesale prices in ensuring the necessary balance and continuity of planning they should be revised no more often than once every five years, a period which makes it possible to utilize the new prices for drafting the next five-year plans.

The utmost increase of the efficiency of social production is a necessary condition of the successful fulfilment of the tasks of the 10th Five-Year Plan and the further development of the national economy of the country. The improvement of the wholesale prices and rates for the industrial products of the fuel, raw material and power sectors and the enhancement of the role of prices in the planned management of the economy are of great importance for accomplishing this task.

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